State of Utah Michael O. Leavitt, Governor

DEPARTMENT OF COMMUNITY AND ECONOMIC DEVELOPMENT
DIVISION OF BUSINESS AND ECONOMIC DEVELOPMENT

David B. Winder, Executive Director
Richard J. Mayfield, Division Director

November 1999

TO: RECIPIENTS OF THE 1998-99 UTAH CENTERS OF EXCELLENCE PROGRAM ANNUAL REPORT

Attached is the Annual Report for the Utah Centers of Excellence Program. The report summarizes the achievements of the program during the fiscal year from July 1, 1998 through June 30, 1999, and, in addition, details the funding allocations for the current 1999-2000 fiscal year.

Since the founding of the Centers of Excellence Program in 1986, the Annual Report has summarized the financial and business accomplishments in terms of dollars granted, matching funds received, jobs created in both Centers and businesses, and other statistical data. This information provides appropriate measures of the status of the program on an annual basis. In addition to the statistical summaries, the report includes descriptions of Utah companies that base all or part of their revenue stream on technologies developed at funded Centers of Excellence and have licensed those technologies from Utah universities. Our intent is to review the Centers of Excellence Program from the standpoint of its influence upon a group of Utah's newest high tech companies. We hope to demonstrate that the funding of the program represents an extremely valuable investment in Utah's current economic base and in the ongoing development of its high technology industries.

The Centers of Excellence Program continues to be one of the nations most successful technology commercialization programs as measured by matching dollars, significant new commercialized products, and state economic impact. We believe that with a continued and strengthened emphasis on the importance of commercialization and with the ongoing support of the new enhancements described, the Centers of Excellence Program will have an ever expanding and important role to play in Utah's economic future.

Respectfully submitted,

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U T A H

Centers of Excellence Program

ANNUAL REPORT

July 1, 1998 - June 30, 1999

Published November 1999

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I. EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Utah State Legislature established the Centers of Excellence Program (COEP) in 1986. They recognized that the growth of new industry and expansion of existing industry is highly dependant on a strong technology base, new ideas, concepts, innovations, and prototypes. Furthermore, the Legislature approved the annual allocation of economic development funds to the COEP, to be awarded to college and university faculty on a competitive basis.

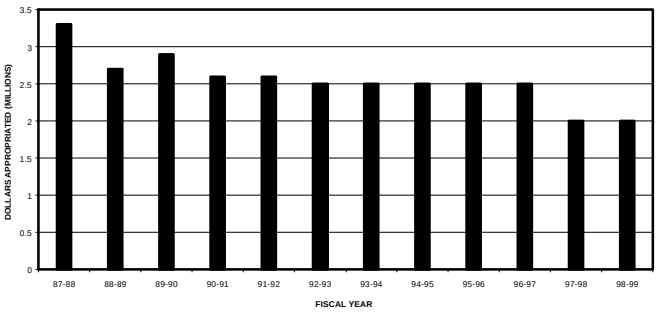
Corporate Headquarters of Myriad Genetics, Inc., a world leader in genetically related cancer research and a spin-off from the Center for Cancer Genetics at the University of Utah.

The goals of the COEP are to enhance and expand selected applied research and development activities, at Utah's institutions of higher education, focused on the development of technologies, which have potential for economic development in the state; and to assist in the actual commercialization of those technologies, in concert with the technology licensing offices at the respective institution. The proprietary value of technologies created is reflected in the number of patents/copyrights issued, which produce royalty-bearing licenses that are signed by businesses. The economic impact is the sum effect of the creation of new companies, the enhancement of business opportunities for existing companies that license COEP technologies, and in the growth of Utah's job opportunities.

During the 1998-1999 fiscal year the Centers Program issued $1.984 million in grants to 16 active Centers (Appendix 1), for use in bringing significant new technologies closer to the marketplace. In the competitive selection process, 12 centers received continued funding and 4 new centers were selected for funding. The Center distribution with respective funding was as follows: eleven at University of Utah ($1,434,000), three at Utah State University ($340,000), and two at Brigham Young University ($210,000). In addition, the program also funded the commercialization consulting effort, at a level of $6,000 per funded Center, for a total of $96,000.

The 16 Centers received matching funds of $11.77 million, resulting in a matching fund ratio of 5.9 to one. The cumulative state funding for the COEP between 1986 and 1999 was $30.7 million and the cumulative matching funds received was $332.7 million, resulting in a matching fund ratio of 10.8 to one. This is believed to be the highest in the nation for programs of this kind and represents a critically important leverage for success in the program.

CENTERS OF EXCELLENCE FUNDING HISTORY



The major accomplishments of the 1998-1999 funded Centers include starting 14 new companies out of which 6 were created during the reporting

fiscal year (Section 2, Center Related Business Activity, of the report). With respect to creating proprietary value, these Centers have received a total of 15 patents/copyrights and have filed for an additional 39 patents. So far businesses have signed 21 license agreements to utilize the intellectual property created by these Centers.

Over the full life of the program, intellectual property created by faculty participating in the Centers of Excellence accounts for 101 patents resulting in 175 license agreements. Since the inception of the program, 132 companies have been created and license proprietary technology from the program. Currently, companies that trace their origins to the Centers of Excellence Program employ an estimated 1300 persons, in the high technology sector of the economy. Surveys conducted by the industry associations (Utah Information Technology Association & Utah Life Sciences Association) report average salaries in excess of $45,000, for Utah's key high Technology segments.

The Centers of Excellence Program continues to be one of the nations most successful technology commercialization programs as measured by matching dollars, significant new commercialized products, and state economic impact. With strong emphasis on the importance of commercialization the program will have an ever expanding and important role to play in Utah's economic future.

II. PROGRAM DESCRIPTION

PROGRAM DESCRIPTION

BACKGROUND OF PROGRAM

The Utah State Legislature created the Centers of Excellence Program (COEP) in 1986 recognizing that the growth of new industry and expansion of existing industry requires a strong technology base, new ideas, concepts, innovations, and prototypes. The Legislature recommended the allocation of economic development funds each year to the COEP, to be awarded to college and university faculty on a competitive basis. The objectives of the COEP are to enhance and expand the applied technical research activities at institutions of higher education in Utah, to develop technologies that are considered to have potential for economic development in the state, and to assist in the actual commercialization of those technologies. This research and technology commercialization process ultimately results in the creation of new companies, the enhancement of business opportunities for existing companies that license COEP technologies, and in the growth of Utah's job opportunities. In addition, the proprietary value of technologies created is reflected in the number of patents issued and the associated royalty-bearing licenses that are signed.

These measurement parameters (jobs created, companies assisted and/or created, inventions disclosed or patents issued, and license agreements signed) are summarized in the report to the legislature as indicators of the value of the COEP to state economic development. The report will also highlight some of the specific businesses which have either been spun off from funded Centers or been materially influenced by Centers of Excellence funding.

Ongoing funding of the program has been based upon the real and potential economic impact that the Centers of Excellence Program has had upon the State of Utah during the years since its creation. This Annual Report summarizes the significant accomplishments of the program during the recently completed fiscal year and attempts to identify the long-term economic value of that work.

PROGRAM OPERATIONS AND OBJECTIVES

The operating methods of the Centers Program have evolved over the years since its inception with a continuing goal of achieving the maximum economic benefit from the individual Centers that have been created. Upon selection on a competitive basis, new Centers are funded with a requirement for a minimum 2:1 matching fund ratio from the private and federal sectors. Matching funds are reported and audited on a regular basis. Centers are also audited regularly for the achievement of technical and commercial milestones. Center directors are required to submit annual reports to the COEP director. The Centers of Excellence Program Annual Report, here attached, is based on submitted reports and upon information gathered in site visits, audits and other data sources. In addition, each funded Center is assisted by one or more designated commercialization consultants who assist Center directors in defining commercialization strategies, performing market and competitive analysis, locating potential investors and or licensees, etc.

Centers are normally funded for a maximum of five years and are then expected to be self-sustaining through license contract royalties and new research grants. Centers with especially noteworthy histories and ongoing technological impact are designated as Distinguished Centers and thereafter may be funded on a project-by-project basis as requests are approved.

CENTER SELECTION PROCESS

Proposals from researchers for new and for renewal of existing Centers of Excellence are submitted to the COEP office in response to a Request for Proposal which is normally sent in late December. The incoming proposals are critically reviewed by the Centers of Excellence Advisory Council. Centers are selected for funding based on a ranking established in extended review sessions with the Centers Advisory Council.

Since its inception, and through FY 1998-99, the program has created 75 Centers of Excellence, seven of which have been designated as Distinguished Centers, 44 have graduated, and 16 are active during this reporting period.

The State Advisory Council for Science and Technology has advisory responsibility for the Centers of Excellence Program by statute. Members of the Science Council participate on the Centers Advisory Council in reviewing proposals and conducting site visits. This provides Science Council members with in-depth knowledge of the program, Center specific information and a strong technical and industrial perspective for making funding decisions. The State Science Advisor reviews the Annual Report and presents it to the Science Council for acceptance. The Director of the Office of Technology Development serves as an ex-officio member of the State Advisory Council for Science and Technology.

COMMERCIALIZATION PROCESS

Over the past five years, the Centers of Excellence Program has funded a consulting program to assist Center directors in preparing and implementing commercialization strategies. Each Center is unique in terms of which strategy is optimal - there is no single solution and each requires customized approaches.

Early market surveys and competitive analysis are conducted to discover which market segments are most promising and which product features will be of interest to potential customers and licensees. Consultants assist in targeting potential licensees for the technology and in positioning products for anticipated markets.

These early strategic discussions often reveal product variations that can be introduced to the marketplace earlier than previously planned. Such early commercialization has several benefits: (i) getting products to consumers for preliminary market validation and directional planning; (ii) early cash flow strengthens continuing research at the Center and hastens financial independence; and (iii) the future value of technology licenses are enhanced.

The Centers of Excellence Office works closely with the Technology Transfer Offices at the respective universities in an effort to extract maximum value from the licenses that are signed for Centers technologies. Through the commercialization consulting program, assistance is given in defining market opportunities, identifying potential target licensees, providing key information for license valuations, and consulting assistance to those companies considering license opportunities.

III. CENTER RELATED BUSINESS ACTIVITY

1. The section introduces new businesses recently incorporated and based on licensed technologies from funded Centers of Excellence. These young companies are representative of the types of high tech businesses that have developed from the Centers Program since its first funding in 1986. It is anticipated that as these companies mature they will have significant economic impact upon Utah's high technology business sector.

2. The section also highlights a selection of more mature Utah businesses that were established on licensed technologies from Centers of Excellence. These companies have achieved significant milestones during the past year that favorably impact Utah's economic base and represent the ultimate purpose and goal of the centers program.

This is a Spin-Off Company from the Center for Self Organizing & Intelligent Systems at Utah State University

Herald Journal - Logan, Utah - Today's date: Sunday, September 26, 1999

THE BRAINS BEHIND THE BLOCKS

By Mike Ingraham
features writer

S.John Wilkin/Herald Journal
George Powell sits with a few of the Lego models his Visionary Products company uses to test ideas. The vehicles are remotely controlled through the Net.

There are those who launch their high-tech pursuits from a garage, and then there are those who can't afford a garage.

However, George Powell did have a bedroom and, after a $2,000 loan, he had a computer.

Four years later, at age 32, he's got a million-dollar business that's "going gangbusters," in Powell's low-tech phrase.

Come up in the world? Heck, Visionary Products, Inc. is headed out of this world. The little Logan firm on Jan. 22, 2002 plans to be on Mars.

That's by extension, of course. Remember Sojourner, the rover crawling over Mars in 1997? Another rover, the Marie Curie, will be at it again in 2002. NASA will be plugged into the Marie Curie and, thanks to VPI software, middle schoolers will be plugged into NASA, sending commands with Mars Surveyor mission scientists.

"Kids will have their own mission control," Powell says, "interfacing with real NASA engineers involved in a real interplanetary mission."

As he speaks he tinkers with a toy, a famous toy. This is Red Rover, the robotic vehicle that, operated from keyboards over the Internet, rolls across "Martian terrain" in schools around the world. Down the hallway, engineer Csaba Gyulai is operating one in Pasadena, then another at Utah State University.

"Here we are in Logan, Utah," he says, "and in a few years we may be able somehow to control Rover on Mars, which is really an amazing thing."

And that's not even mentioning that they do it from a basement behind a bowling alley. Not all of VPI's engineers - there are 17 full time, all part owners - can squeeze into this little warren of rooms at 40 W. Skyridge. Powell himself is doubling up, sharing space with business manager Janelle Jones, who's at a table crammed against a wall.

"Growing pains," says Powell.

Six new engineers may soon come on board. Powell likes to say that VP comes up with "out-of-the-box solutions" but can these space engineers engineer themselves out of their own little brick box at

Skyridge?

As with most questions at VPI, the answer is yes. Relief is literally in sight, right next door. VPI will move to the neighboring building where they will huff and puff and hopefully come up "with a new product I can't tell you about yet."

But Powell can't stop smiling, maybe because this mystery product has helped the firm gross as much in one year as in the other three years combined.

So the best may be yet to come, although Mars is a hard act to follow. On its upward trajectory, looking into the rearview mirror, VPI sees an old friend, a parent almost, becoming smaller and smaller. This is Utah State University, the alma mater of most of VP's engineers, including Powell, who has two degrees in electrical engineering.

From his bedroom in Pasadena, Calif., Powell spun off VPI from USU's Center for Self Organizing Intelligent Systems and looked to USU's Space Dynamics Laboratory for early contacts and contracts. When it came time to get serious, Powell, who is from Salt Lake City, left the NASA/Jet Propulsion Laboratory and returned to Cache Valley.

"Obviously the draw is the great talent coming out of Utah State," he says. Now, however, that "we're going after bigger fish" VPI is having to "scale back with USU. I can't say enough good things about engineering at USU," Powell hastens to add.

There is a draw in Cache Valley and also a drawback. VPI may be going to Mars, but can't fly in its own backyard.

"The biggest problem is distance from a major airport," he says. "The big players, for them to fly to Salt Lake City, then drive an hour and a half and then back costs them a minimum of two days. It causes tremendous pain."

VPI is not yet a firm of 30-year-old millionaires in jeans and tennis sneakers, but there is money to be made taking chunks from Microsoft, Hewlett-Packard and IBM. VPI's a hungry shark swimming with whales in the high-tech ocean.

"We usually go after problems other people can't solve for the same amount of dollars or time that we can," Powell says. "We have to be better than Boeing or Martin-Marietta or we'll lose to them.

"We've taken business from $100 million companies because we can do it a lot faster. But we can't afford to make the same mistakes as they do, because if the customer goes, we're out of business."

"Faster" means the lights are always on at 40 W. Skyridge where the one discovery they don't want to make is that they've become robots themselves.

That's one reason Powell prizes an "office environment" instead of sending everyone home to telecommute. "It's critical to the creative aspect, much more conducive to creativity than trying to arrange everybody on a phone call. We have changes on an hourly basis here and we have to be a tight-knit team to pull it off."

Whether with customers or colleagues, there's nothing, he says, "like a face-to-face meeting."

There are no environmental or chemical or civil engineers at VPI, but the breed is otherwise there in force. VPI, after all, advertises itself as a "turn-key product developer" which can do it all.

Powell elaborates. "The customer says, 'Here's an idea I have for a product.' We'll do the design, implement a prototype, get it into manufacturing for them, and then say 'Here's the software design, the hardware, the electrical design, the manufacturer.' Basically all they have to do is tell us where the product needs to be shipped."

Just like that. The customers' products seem to have a smoother ride than Powell's own idea for a product, a high-tech engineering business. VPI has "had about almost every problem you can possibly imagine.

"It's been long, hard, grueling ... I would not recommend opening a business to anyone."

George and Janelle Powells' baby Hannah, for example, was conceived and born in the time it took her dad to get through the vice president's door at Lego Corporation. Actually, Powell didn't even get through the door. The VP gave him 10 minutes in a San Francisco lobby.

But in all its work with space flights, that red-eye flight to San Francisco may have been the biggest for VPI. Powell as early as 1994 had been discussing with the Planetary Society the idea of using Lego vehicles to teach about exploration.

He also knew that Lego needed to compete for a new generation of kids, the video arcade kids. So how about an interactive, electronic Lego with smart blocks, ones with microprocessors and motors and sensors?

"We were accepted with open arms," he recalls, and soon "Red Rover Red Rover" was roving through the world's schools, miniature replicas of Sojourner that students steer from their keyboards. The program is in its fourth version, each one taking Gyulai a year or more to write.

"First students learn about Mars," Powell explains. "They build a Marscape from cardboard or clay or sand or whatever, then they build the robotic vehicle, with motors, gears and receptors.

"The exciting thing is that it's Internet-based. You can log onto another school down the road or in Denmark and explore their Mars terrain. There are kids who build their robots, pack them in boxes and mail them to other schools, like they're launching to Mars. They are operating their own robot around the other school's Marscape."

But having said this, Powell adds, "You think this is neat, you wait until Mars 2001. It will make this stuff look like toys."

The Mars Surveyor 2001 Lander Mission launches April 2001 and, here on Earth, will link students to scientists working on experiments, including at least one designed by a student.

Powell sees the adventure as opening the doors to more public - rather than "elite" - participation, the Internet influence. NASA also stands to gain by increasing public support.

In a way, VPI may be like its client Lego, building blocks that lead to who knows what. Their square little office building even looks like a Lego block, a modern Lego, one smart box.

This is a Spin-Off Company from the Center for Value Added Seed Technology at Utah State University

F_1 TECHNOLOGIES

F_1 Technologies – a development-stage spin-off from the **Center for Value Added Seed Technology at Utah State University**– has developed a revolutionary technology, **apomixis**, with numerous valuable and multifaceted commercial applications. Apomixis is an emergent "cloning" technology for plants that will substantially reduce costs, **increase yields of food, feed, and fiber crops (10% to 40%)**, and greatly reduce the time required (by 50% to 80%) to bring new agbiotech advances to market. Apomixis is a platform and enabling technology – a biological "operating system" – that will be universally essential to competitive agribusiness worldwide. Apomixis enables plant breeders to clone plants, which possess valuable traits, through the plant's own seed – generation after generation – perpetually. This genetic fixation makes apomixis of immense value – **several billion dollars annually** to the seed, agbiotech and plant-breeding industries. F_1 Technologies – the first and only company dedicated to the development of apomixis – controls the *key* intellectual property necessary to unlock the power of apomixis.

In addition to commercial benefits, apomixis has enormous humanitarian potential for feeding an ever-growing world population. Apomixis may be the single most cost effective plant mechanism for transferring biotech and productivity advances to small farms in the U.S. and to subsistence farmers in the developing world. Without compromising business opportunities for F_1 Technologies, apomixis can become a conduit for affordable and equitable globalization of significant agbiotech advances. It may well become one of the most important platform and enabling technologies of the second green revolution.

Our products are apomixis technology and apomictic seed. F_1 Technologies plans to obtain income from product development contracts (to produce apomictic crops), royalties, and seed sales in niche markets. Major benefits accruing to agribusiness include increased productivity, faster to market at reduced costs, and rapid anchoring of value-added traits. Potential royalties from major crops and from sales in niche markets have been calculated at several hundred million dollars annually. We conservatively project breakeven within 4 years and profitable operations within 5 years. Our technology position is established by a patent application, "Methods for Producing Apomictic Plants," which is fundamental to the many business applications that will be enabled by apomixis. Research leading to additional patents is underway. With timely funding and aggressive development of products, **F_1 Technologies can dominate a pivotal new technology.**

The many potential applications of apomixis to crop improvement were summarized at a recent Rockefeller Foundation sponsored conference. They reported the following: **"The prospect of introducing apomixis into sexual crops presents opportunities so revolutionary as to justify a sustained international scientific effort. If apomixis were generated with a sufficiently high degree of flexibility, the impact on agriculture could be profound in nature and extremely broad in scope."**

This is a Spin-Off Company from the Center for Industrial Imaging at the University of Utah

Chemical Fingerprinting & Environmental Forensics

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Sandy, Utah 84093
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http://www.gcmetrix.com

Identification and apportionment of contaminant sources is an important but complex problem in the assessment of hazardous waste sites and sensitive ecosystems. It is particularly difficult in highly urbanized/industrialized areas where the number of potential sources is unknown. Over the past seven years, a relatively new environmental data analysis technique known as polytopic vector analysis (PVA) has proven useful in the investigation of co-mingled contaminant plumes. PVA has provided the ability to "unmix" multiple source fingerprints without assuming their number, chemical spectra or geographic distribution. The application of PVA to environmental geochemical data was developed at the University of South Carolina and the University of Utah.

ABOUT GEOCHEM METRIX

GeoChem Metrix is the first spin-off company resulting from the Center for Industrial Imaging at the University of Utah. PVA is being applied on commercial consulting/environmental engineering projects by **GeoChem Metrix, Inc.** of Sandy, Utah. GCM is a small service company that focuses on multivariate data analysis, environmental chemical fingerprinting, petroleum fingerprinting and associated training. GCM President Dr. Glenn Johnson, has over 10 years experience in environmental consulting, chemometric algorithm development and university-based research. Dr. Johnson's environmental engineering/consulting experience includes chemical fingerprinting for litigation support, RCRA Facility Investigations, CERCLA RI/FS and Remedial Design investigations, Phase I/Phase II environmental audits, and environmental site assessments under a number of state regulatory authorities. Dr. Johnson was Assistant Director of the Center for Industrial Imaging at the University of Utah (CII) from 1995 to 1999. CII, is a graduated Center of Excellence, part of the Utah Centers of Excellence Program, that encourages development and commercialization of leading-edge technologies at Utah universities. GeoChem Metrix is the first spin-off company resulting from CII commercialization efforts. GCM maintains a strategic alliance with the University of Utah, and Dr. Johnson retains his position as a research scientist at the Energy and Geoscience Institute, University of Utah.

CASE STUDIES

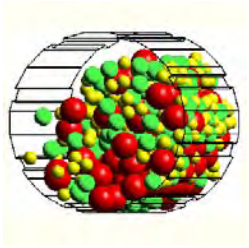
Published environmental applications include source apportionment of dioxins and furans in Newark Bay, New Jersey; metals in sediments from Bayou Trepagnier, Louisiana; PCBs in surface water of San Francisco Bay; and characterization of crude oils in producing oil fields. GeoChem Metrix scientists have conducted chemical fingerprinting projects for clients, including the following:

(1) Polynuclear aromatic hydrocarbons (PAHs) in river sediments (environmental litigation support);
(2) Polychlorinated Biphenyls in river sediments (environmental litigation support);
(3) Major-ions in groundwater (low-level nuclear waste disposal facility site selection process);
(4) Toxic metals in groundwater (environmental litigation support); and
(5) Dioxins/furans in river sediments (litigation support and Remedial Investigation/Feasibility Study).

This is a Spin-Off Company
from the Center for Minerals Technology
at the University of Utah

Milltech Engineering

Milltech Engineering Company was started in February 1999, in response to a strong demand for the use of Millsoft simulation software, developed at the **Center for Minerals Technology, University of Utah**. The company provides consulting services on suitable lifters and liners for semi autogenous mills, and on other mill related engineering problems. The following company website has this URL address: http:// www.milltecheng.com



Milltech Engineering Co.

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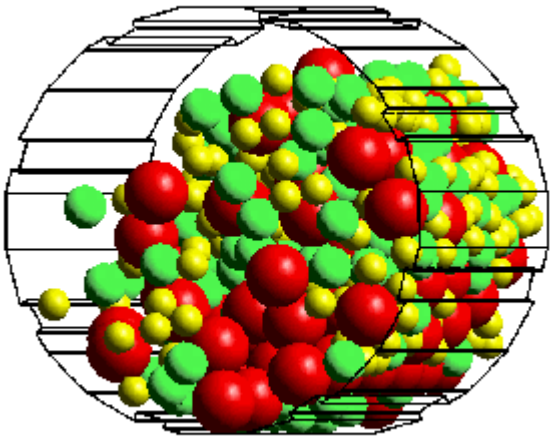

From Research to Practice

Welcome!

We use cutting-edge modeling techniques and advanced simulation tools to devise practical solutions to your problems. We are best known for writing the software **Millsoft** ® , the ultimate tool for tumbling mill

simulation. Our main field of applied research is **SAG mill liner design**, pulp lifters analysis, and specialized sensors development. Our clients have experienced dramatic increase of throughputs and large savings in metal wear.

We are also introducing the power of Computational Fluid Dynamics (CFD) to the world of Particle Technology. The main achievements in this area have been hydrocyclone modeling and swirl flow air cleaner design. Other potential targets for CFD are flotation cell hydrodynamics and dry cyclone reactors.

We have developed a new ultrafine grinding mill for fast production of micron size particles in a continuous manner. This technology is useful for pharmaceutical applications, high performance ceramics, cosmetics, paints, pigments, toner ink, nuclear fuel postprocessing, etc.

Finally, we will be glad to look at other problems that cannot be solved with traditional methods.

Contact us:

Fill our on-line **Contact Form** or write to us at the address below.

Milltech Engineering Co.

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This is a Spin-Off Company from the Center for Cell Signaling at the University of Utah

SALUS THERAPEUTICS INC.

Salus Therapeutics Inc. has its origins in the **Center for Cell Signaling at the University of Utah**. The company is using a novel technology for discovery of optimal drug targets for antisense therapeutics. This technology, developed at the University of Utah, has been validated in a model system. The technology can be broadly applied to most disease states that result from aberrant gene expression. Salus will initially focus on multiple sclerosis, cystic fibrosis, inflammatory diseases, and diseases of viral and neoplastic origin.

Antisense molecules are a new class of therapeutics that specifically target and inactivate disease-causing genes. These agents have promised to be highly potent therapeutics that, due to their high specificity, are expected to be free of side-effects commonly encountered with traditional small molecule pharmaceutics. The promise of these new biopharmaceutics is only now being realized with FDA approval of the first antisense therapeutic. Several others are in various stages of clinical trials.

As for traditional pharmaceutics, the cost to take an antisense therapeutic from discovery to FDA approval is estimated to be $500 million. It is therefore imperative that the very best antisense target be identified for development as a therapeutic. A typical gene will possess thousands of potential targets, and only one or a few may be optimal.

Until now it has not been possible to identify the optimal target(s). This can now be achieved using the Company's newly developed technology. The Company's approach is rapid and inexpensive. It will speed up the process of drug discovery and insure that only the most potent antisense agents are developed for therapeutic use.

Salus was founded by Duane Ruffner, Ph.D. and Dinesh Patel, Ph.D. (formerly President & CEO of Theratech) with assistance and support provided by the Center for Cell Signaling. The lab and office space for Salus is located at 615 Arapeen Dr. in Research Park. Dr. Ruffner has been a CCS member for over a year now.

This is a Spin-Off Company from the Center for Signal Processing at Brigham Young University

SONIC INNOVATIONS

SONIC innovations, Inc. had its origins with the **Center for Signal Processing at Brigham Young University**. The technologies developed by the center were intended to enhance the quality of amplified sound to the human ear. Using digital technologies and by selectively amplifying or attenuating certain frequency ranges, the technology enhances the hearing level of sound, significantly reduces background noise, and attempts to mimic the auditory amplification and recognition systems of the human ear and brain. The mathematical algorithms developed at the center and the resulting electronic circuitry and integrated circuits are now used in the brand of NATURA hearing aids produced and marketed by SONIC innovations, Inc. The technology, a type of graphic equalizer for the ear, can be custom tuned for each individual user using software provided to the auditory specialists who will prescribe the hearing aids. The company has seen rapid growth since it introduced the NATURA product in September 1998 and is currently struggling to meet the increasing demand for its products. The following corporate summary was provided by SONIC innovations, Inc. from their internet site at www.sonicinnovations.com:

One in ten Americans suffers from hearing loss severe enough to interfere with the understanding of normal human speech in common, everyday environments. Hearing loss has a serious impact on the quality of life for these people and degrades the general standards of communication and quality of life for the hearing impaired. There are over 25 million Americans with hearing impairment and more than 300 million hearing-impaired people worldwide. Only slightly more than 20% of the more than 25 million Americans who could benefit from a hearing aid have actually purchased one to improve their hearing and understanding. Of those buyers, studies reveal that only approximately 50% are satisfied with their current hearing instruments.

Privately held **SONIC innovations** was founded to address this issue by providing a new type of hearing aid that produces more natural sound. Headquartered in Salt Lake City, Utah, **SONIC innovations** is using patented, proprietary digital signal processing (DSP) technologies based on the smallest and most powerful computer chip ever installed in a hearing aid, to set new standards for delivering natural sound to the hearing impaired. After 30 years of evolution, some of today's hearing aids are inexpensive, some are small, some are comfortable, some have fairly good sound quality, some are easy to dispense and some require little service. Yet very few offer more than two features from this list. **SONIC innovations'** NATURA line of hearing aids integrates these characteristics while greatly enhancing the quality of hearing for the user through the ability to personalize the parameters of NATURA to the unique needs of the individual.

As the Baby Boomer Generation ages, the population of the hearing impaired is swelling at more than 10% each year, while hearing aid sales are rising at a rate of only 5% per year. Why? For years, the hearing aid industry has failed to deliver on the promise of providing a natural sound experience to the hearing impaired. The great majority of hearing aids on the market today simply amplify sound, the equivalent of just turning up the volume on a stereo. This is not an effective solution for the hearing impaired because all sounds are amplified and hard-to-hear consonants often disappear.

Ironically, while people have benefited from vast improvements in the sound technologies of the music industry, the hearing-impaired community has been left behind. While it is common for consumers to have upgraded from LP to cassette to digital CD, 80% of hearing aids sold today are manufactured using 30-year-old technology. Most individuals using hearing aids are hearing life broadcast at them with the same poor sound quality as a 78-rpm record. The other 20% of hearing-aid users are using newer hearing aids that result in a sound quality similar to that of cassette tapes. Recent advances in hearing-aid technology have become a bit more sophisticated and add some level of customization roughly comparable to adjusting the bass and treble of a stereo. But because

every hearing impaired individual's hearing loss is slightly different, dissatisfaction remains high. In fact, up to 20% of all hearing aids purchased are ultimately returned.

SONIC innovations' breakthrough NATURA hearing aid more than doubles the level of programmable customization for the hearing aid, tantamount to providing a graphic equalizer for the hearing impaired. After individual audiological testing, the dispensing hearing-care professional tailors NATURA's programming for the user with a hand-held 3COM PalmPilot. The result: for the first time, a highly customized hearing aid that strives to closely mimic natural sound.

NATURA offers the first major advance in actual hearing technology in close to a decade. Dr. Douglas Chabries, Dean of the College of Engineering and Technology at Brigham Young University, developed a new algorithm for processing audio signals. This mathematical formula is based on a new understanding of how the human auditory system relates to sounds. The new algorithm has proven to make significant progress in reducing the effects of hearing loss for hearing impaired individuals. Dr. Chabries collaborated with Dr. Thomas Stockham, a pioneer in the digital recording field who is best known for inventing digital recording, and Dr. Carver Mead, professor of computer science at the California Institute of Technology, to develop the core digital sound processing technology that is today embedded in a tiny microchip in **SONIC innovations** hearing aids. As a result of this team's collective innovation, NATURA processes sound at a rate of 50%-90% faster than traditional hearing aids. Hence, individuals wearing NATURA are essentially hearing at the speed of sound.

Because of the power and tiny size of the computer chip that drives NATURA, a large percentage of hearing-impaired individuals may be able to wear the aid completely hidden in the canal (CIC), making it virtually invisible and mitigating the stigma that prevents many hearing-impaired individuals from purchasing a hearing aid. According to the Better Hearing Institute, more than 9 million hearing-impaired individuals actually refuse to buy an aid because of the social stigma of wearing a visible aid. **SONIC innovations** has brought together a collection of visionaries from both the science and business worlds. These industry leaders have combined their considerable expertise in order to improve the quality of life for the hearing impaired. The people behind the NATURA hearing aid see their accomplishment as one that not only enhances people's abilities to hear and communicate but also enhances happiness and improves lifestyle. After all, the ability to hear is essential to interpersonal communication. And communication is integral to the quality of life.

SONIC innovations is led by an experienced management team with decades of experience in the medical field. The **SONIC innovations** team is headed by President and CEO Andrew Raguskus, who brings to the company nearly 30 years of management experience and expertise delivering high tech breakthrough products to market. Raguskus is joined by Gregory Koskowich, Ph.D., vice president, Engineering; Jeannette S. Johnson, Ph.D., vice president, Research & Regulatory; Jorgen Heide, vice president, Business Development; Robert Wyckoff, vice president, Operations; William S. Barth, vice president and CFO; Orlando P. Rodrigues, vice president, Marketing; and Michael D. Monahan, vice president, Sales.

SONIC innovations is funded by several top-tier venture capital organizations, including Utah Ventures, Accel Partners, Venrock Associates, Morgenthaler Ventures, New Enterprise Associates, The Travelers Companies and MAM Asset Management. Investments totaling more than $31 million have been used to develop and patent the core technology and to fund technology and U.S. market introduction.

SONIC innovations believes that it offers revitalized comfort and enjoyment to those who are unfortunate enough to be missing the simple pleasure of a normal conversation.

This is a Spin-Off Company from the Center for Aerospace Technology at Weber State University

ONE STOP SATELLITE SOLUTIONS, INC.

One Stop Satellite Solutions, Inc. (OSSS) is a relatively new company that had its origins with the **Center for Aerospace Technology at Weber State University**. The company designs and produces small commercial satellites using proprietary technologies licensed from Weber State. In October 1999 the company completed and shipped its first commercial satellite (JAWSAT) scheduled for launch at Vandenberg Air Force Base in California. The following information was taken from the OSSS web site at www.OSSS.com and from press releases relating to the JAWSAT satellite:

From the web site:

For years, large expensive satellites were required to perform most valid scientific and commercial space missions. Today, there is a need for cost effective small satellite options. One Stop Satellite Solutions (OSSS) has developed low earth orbit satellites that have the capacity to reduce mission costs and increase mission capabilities.

As a full service satellite company, OSSS can provide customers with a one-stop approach to meeting their needs. Key alliances allow OSSS to provide the satellites, launch services, ground control, and data collection needed by customers.

OSSS's technology and innovative design solutions make small satellites with large satellite features possible. Capabilities include:

- Receiving, storing, and transmitting data for communications
- Scientific experiments
- Space rating of parts
- Research work
- Non-real time communication applications
- Remote sensing
- Other untapped commercial applications

OSSS's mission is to provide its customers with low cost, high quality small satellites for more effective access to space. OSSS satellites use state-of-the-art technology that has been developed by the Center for Aerospace Technology (CAST) at Weber State University with support from the Utah Centers of Excellence Program. OSSS technologies have proven space experience and can provide major cost savings compared to current industry competitors. These technologies, combined with the OSSS management team, can fulfill NASA, government, education, and commercial missions.

This is a Spin-Off Company from the Center for Aerospace Technology at Weber State University

From Utah Economic Development Newsletter
October 1, 1999

CENTER OF EXCELLENCE, SPIN-OFF COMPANY TO BUILD SMALL, LOW-COST SATELLITE

The Centers of Excellence Program in the Utah Department of Community and Economic Development has once again helped bring innovative technology to the marketplace.

The Center for Aerospace Technology at Weber State University and One Stop Satellite Solutions (OSSS) of Ogden have developed a unique vehicle designed to deploy small satellites into orbit and then it becomes a satellite itself.

With four satellites attached, the Multi-Payload Adaptor space frame, or MPA, will be launched Oct. 15 from Vandenburg Air Force Base near Santa Barbara, Calif. The MPA consists of six aluminum isogrid pieces cut by water jets and assembled in a windmill-like design. The frame can be easily and quickly proportioned for multiple applications and payloads. Connected to the windmill-like pieces are four small, lightweight satellites—one each from Arizona State University and Stanford University and two from the Air Force. Once in orbit, they will serve a variety of scientific research and communications functions. They include providing earth imagery, aiding amateur radio operations, taking measurements in space, gauging the electrical charges of parts of a spacecraft and how those charges vary in different parts of orbit.

The MPA is only 30 inches by 30 inches. With the attached satellites, it stands about five feet tall and weighs 416 pounds. Construction of the MPA started in June 1998 and was recently completed at a cost of $1 million. In developing the MPA, the goal of OSSS and the Center for Aerospace Technology is the quick, low-cost delivery of small satellites into orbit for business, educational, government, and military purposes. The standard time for the manufacture and launch of a satellite has previously been 3 to 5 years at a cost of several million dollars, according to Michael Wood, project manager at CAST.

Once those four satellites are deployed, the MPA itself will become a satellite to conduct experiments for Weber State University and NASA's Marshall Space Flight Center in Huntsville, Ala.

The MPA will be transported in a modified trailer from Ogden to Vandenburg AFB Sept. 20 to prepare for the October launch.

One Stop Satellite Solutions (OSSS) was created as a technology transfer company licensed to manufacture and market low-cost satellite technology developed by the Center for Aerospace Technology (CAST). CAST was funded by the Centers of Excellence Program at the Utah Department of Community and Economic Development to complete the late stages of research and then commercialization of small low-orbit satellites. Thus, medium and smaller-sized businesses and organizations can affordably launch and use the satellites to gather and transmit data.

The Centers of Excellence Program is a state-funded program that supports selected research programs at Utah's universities. Programs are selected based on leading-edge research activities that have projected commercial value. The objective is to encourage the commercialization of leading-edge technologies through licensing patented technologies and creating new companies and thus enhancing Utah's economy. **(www.dced.state.ut.us/techdev)**

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IV. 1998-1999 FUNDED CENTERS

CENTER FOR ADVANCED STRUCTURAL COMPOSITES

CENTER

The Center for Advanced Structural Composites was first funded in 1998 to develop the commercial potential of fiber reinforced composites by improving the strength, stiffness, damping, and acoustical performance of structures manufactured using advanced composite materials.

TECHNOLOGY

The core technologies consist of an ultra-lightweight composite structural shape known as the **"IsoTruss"** and a damping enhanced **wavy composite material** system. The **wavy composite material** utilizes carbon fibers layered in sinusoidal patterns on laminated material to enhance acoustic damping characteristics without compromising strength or stiffness. The **IsoTruss** structure is made of carbonfibres wound in a complex geometric pattern and stabilized through an epoxy cure cycle. The resulting lightweight structure exhibits extreme rigidity and torsional strength. The technology has the potential for various functional applications including aerospace, automotive, support towers, heavy construction support members, and preformed concrete beams.

ACCOMPLISHMENTS

A new business, **Patterned Fiber Composites, Inc.**, has been established with license rights to produce products using the damped wavy composite technology. The company has been awarded a $950,000 Phase II SBIR contract from the USAF to commercialize the technology. With the licensing of this technology, the Center focus has moved primarily to the IsoTruss technology. The Center is working with several industrial partners to develop a variety of new products using the IsoTruss technology. Contemplated applications include lightweight bicycle frames, freeway sign supports, tilt-up wall braces for construction, and powerline support towers.

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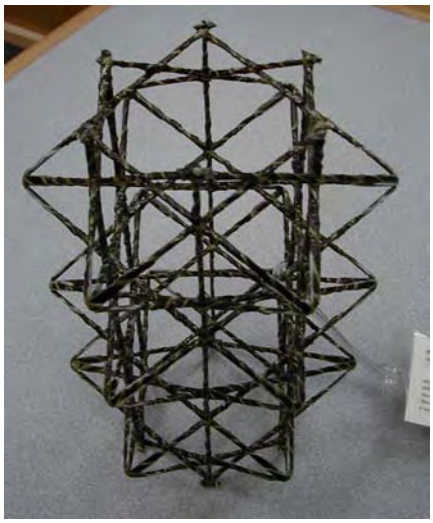
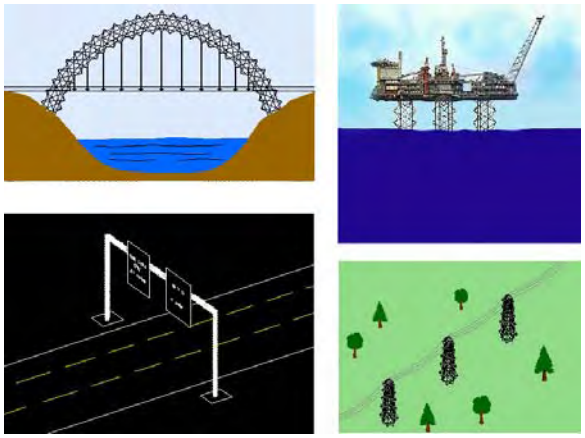
Can You Imagine...

... a powerline transmission tower that can withstand extreme wind conditions, support tremendously heavy loads, is corrosion free, unaffected by temperature extremes, and weighs significantly less than conventional steel towers.

THE CENTER DEVELOPS FIBER REINFORCED COMPOSITE MATERIALS AND STRUCTURAL DESIGNS THAT ARE LIGHWEIGHT, STRUCTURALLY RIGID, AND EXTREMELY STRONG.



* An example of the IsoTruss structure that provides extreme rigidity and torsional strength in a very lightweight configuration.



Some anticipated applications for the IsoTruss technology.

CENTER FOR ASYNCHRONOUS CIRCUIT AND SYSTEM DESIGN

CENTER

The Center was established in 1997 to complete the development of software design tools that will allow engineers to efficiently design digital circuits that do not require global clocking circuits in order to operate.

TECHNOLOGY

While most of today's digital systems use a synchronous global clock to coordinate operations within an integrated circuit, the challenge of distributing such global clock signals becomes increasingly difficult as circuit densities increase. Asynchronous circuits do not require a global clock and therefore do not require clock distribution lines as traditional synchronous circuits do. Industry has not moved to asynchronous design in large part owing to a lack of computer aided design (CAD) tools supporting this technology. Meeting this need is the direct target of this Center. It is working with companies such as Intel and IBM not only to help solve their future asynchronous design problems, but also their current difficulties in the analysis and verification of high-speed integrated circuits.

ACCOMPLISHMENTS

The Center has filed its first patent application representing nearly 100 claims and is considered a major invention. Significant design verification work was completed at IBM's Austin Research Laboratory, the results of which have led to the funding of a new research proposal by Semiconductor Research Corporation and to an anticipated license agreement with IBM. The Center has entered into collaboration with **SONIC innovations**, a Utah company, designing digital hearing aids. A major new grant was also received from the National Science Foundation to explore asynchronous designs for digital communications

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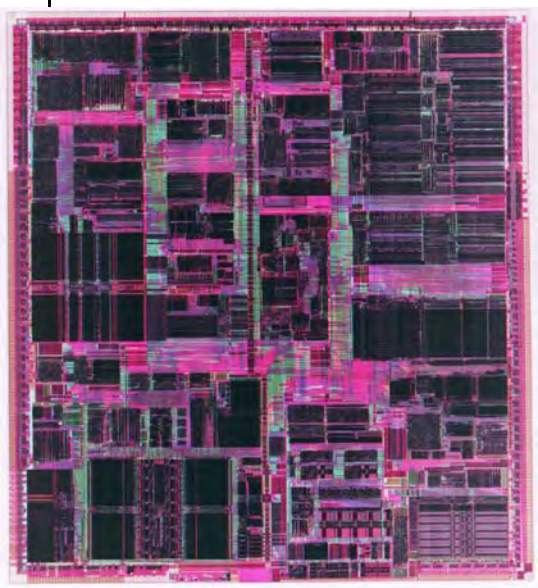
Can You Imagine...

. . . a personal computer that runs significantly faster than today's models because it does not depend on an internal clock to synchronize its various operations?

THE CENTER DEVELOPS DESIGN TOOLS FOR DIGITAL ENGINEERS CREATING NEW MICROPROCESSORS



■ The Intel P6 400 MHz microprocessor as seen through a microscope. Up to 30% of the surface area of a high speed microprocessor chip may be required to distribute clocking signals. (Photo courtesy of Intel Corporation)

CENTER FOR BIOMOLECULAR TECHNOLOGIES

THE CENTER

Established in 1998 to develop and commercialize technologies aimed at improving the efficiency of detecting rearrangements in the human genome and reducing the high cost of genetic microarrays, i.e., "gene chips", which are ideally suited to unraveling complex genetic information. Each of these aims promises to remove major technological impediments in the biotechnology and health fields. For example, the inefficient methods to detect chromosome rearrangements have hitherto limited their use in the early detection of cancer, environmental health, and population genetics, even though such rearrangements are known to provide important diagnostic information.

THE TECHNOLOGY

To improve the efficiency of detecting genetic rearrangements, the Center technology is focused on the development of proprietary reagents, methods, and kits that permit the bulk isolation and quantification of DNA with either specific or random rearrangements from, e.g., a small blood sample. This technology promises to replace the present methods, such as fluorescence microscopy and polymerase chain reaction (PCR) analyses, in the detection of such rearrangements.

To reduce the cost of microarrays, the Center technology is focused on developing devices and reagents that would serve to actively transport DNA, proteins, cells, or other small objects into low-cost, disposable arrays. Each array may have hundreds of thousands of uniquely addressable microlocations. The Center's novel proprietary approach provides an opportunity for substantial cost reductions in the microarray technology along with significant enhancements in user applications.

THE ACCOMPLISHMENTS

The Center's efforts during FY99 were principally focused on the development of model systems, proof-of-principle demonstrations, and on disclosures and patents to secure these proprietary technologies. Initial model systems were developed and successfully tested for both technology types. The DNA rearrangement technology has developed rapidly and it is anticipated that a spin-off company will be created in FY01 to focus on health and environmental applications, including the marketing of reagents and kits.

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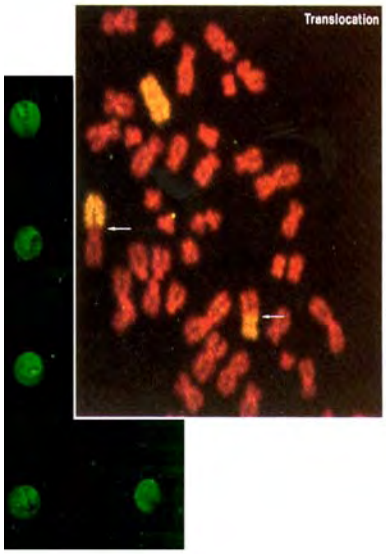
Can You Imagine...

. . . detecting the development of cancer years before the appearance of any symptoms, at a time when intervention may be highly effective?

THE CENTER DEVELOPS AND COMMERCIALIZES NEW TECHNOLOGIES FOCUSED ON THE EARLY DETECTION OF CANCER AND LOW COST DISPOSABLE MICROARRAYS.

The Center technology would



eliminate the need for costly cytogenetic analyses to detect chromosome rearrangements such as the translocation identified in the above microscope image (modified from Straume et al. 1992). Instead, the Center's proprietary reagents and methods are used to extract and quantify such events directly from bulk samples of cells. Also shown above is a small part of a test array consisting of proprietary reagents with properties that permit efficient positioning and detection. The array reagents, together with special array devices, are designed to actively transport DNA, proteins, cells, or other small objects into low-cost, disposable microarrays.

CENTER FOR CELL SIGNALING

THE CENTER

Established in 1997 to identify new therapeutic targets and new drug candidates for asthma, allergy, inflammation, and cancer. Each of these diseases arises because cells are communicating the wrong information, which can be fixed by disrupting incorrect messages and providing correct signals. The Center now has 18 participating faculty members from eight different departments at the University of Utah, one from BYU and two from USU, focusing their talents in a synergistic way to create and commercialize new technologies.

TECHNOLOGY

The Center technologies focus on the synthesis and drug applications of new molecules involved in cell-cell communication, from controlling the biochemical pathways of signal transduction to designing instruments used to study these processes. Current developments include tools necessary for the elucidation of chemical pathways that regulate normal and abnormal cell responses. These tools include chemical synthesis, expression of recombinant proteins, preparation of monoclonal antisera, biomolecular interaction analysis, and phage display of high affinity peptides.

ACCOMPLISHMENTS

This year the center faculty has filed 26 invention disclosures and seven full or provisional patents. **A new company has been spun-off, Salus Therapeutics, Inc.** The company's focus is on identifying ribozyme and antisense targets for specific diseases. The company has research collaborations with the Center and has received two SBIR awards for over $850,000. **Echelon Research Laboratories,** spun-off last year from the Center to market reagents and kits for identifying oncogene activators and suppressors important in cancer diagnosis, also has R & D collaborations with the Center and has received six SBIR/STTR awards for a total of over $1 million.

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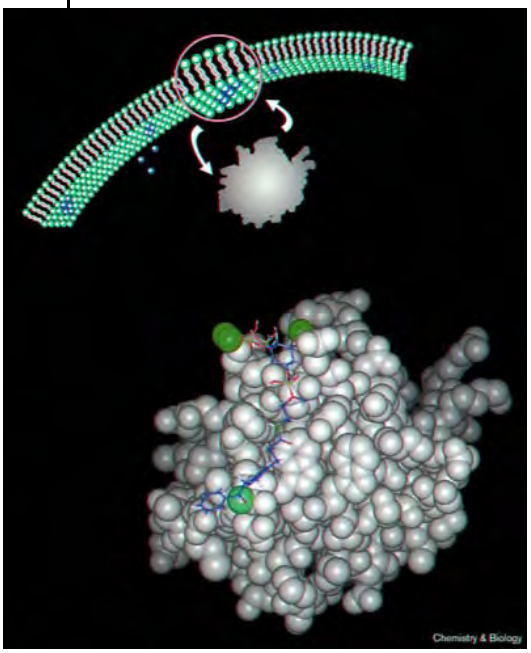
Can You Imagine...

. . . a new class of pharmaceuticals that provide therapeutic effects by artificially signaling selected cells in the body to perform desired actions to the benefit of the patient?

THE CENTER DEVELOPS AND COMMERCIALIZES NEW TECHNOLOGIES FOCUSED ON THE TREATMENT OF CANCER, ALLERGY, ASTHMA AND INFLAMMATION.



- Image was on the front cover of *Chemistry & Biology* & illustrates the recognition of a signaling lipid (PtdInsP2) in a cell membrane by a protein (profilin) in the cytosol that controls the reorganization of the actin cytoskeleton during cell replication, growth, movement, & adhesion. It is from the paper A. Chaudhary, J. Chen, Q.-M.Gu, W. Witke, D.J. Kwaitkowski, and G.D. Prestwich, Probing the Phosphoinositide 4,5-bisphosphate Binding Site of Human Profilin 1, *Chemistry & Biology*, Vol. 5, 273-281 (1998). This is exemplary of the founding technology for Echelon Research Lab, the first CCS spin-off company.

CENTER FOR COMPOSITES IN CONSTRUCTION

CENTER

The Center for Composites in Construction was funded for the first time this year. The Center has a primary focus on composite materials that may be used to strengthen or reinforce precast concrete structures such as bridge columns, freeway overpass beams, concrete walls and other structural components. The basic technology utilizes fiber-reinforced polymers woven into industrial fabrics that can be used to wrap structures or be imbedded in precast concrete designs.

TECHNOLOGY

The Center has developed a patent application for “Fiber Reinforced Polymer" (FRP) composite connections of precast concrete walls. The Center has also developed and verified FRP composite connections for strengthening bridge joints. The Center develops design guidelines and specifications for the strengthening of columns and seismic retrofit of bridge caps and joints with FRP composites.

ACCOMPLISHMENTS

One patent application is underway as noted above. The Center has been actively involved in technology transfer with the Utah Department of Transportation. Dr. Pantelides has presented a short course to UDOT structural engineers regarding the design of FRP composite retrofit of bridges. As a result, more than 70 columns of I-80 bridges will be retrofitted with the composite wraps. In addition, the State Street bridge on I-80 will get a seismic retrofit using FRP composites. The Center has also provided consulting assistance to several Utah companies including Thiokol, Monroc, Inc. (Eagle Precast Co.), Sika, Hydrotech, Waterpoint, and EDO Fiber Science.

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Can You Imagine...

. . . rehabilitating aged freeway bridge columns and beams by wrapping the concrete structures with a fiber reinforced fabric that would allow the structures to meet stringent seismic codes?

THE CENTER DEVELOPS TECHNOLOGIES FOR INFRASTRUCTURE REHABILITATION AND NEW CONSTRUCTION USING FIBER INFORCED POLYMER (FRP)

COMPOSITES

- I-15 in process

CENTER FOR DAIRY TECHNOLOGY COMMERCIALIZATION

CENTER

Established in 1998, the main goal of this Center is to commercialize technologies developed at the Western Dairy Center, whose research is funded by a consortium of dairy food companies, for a variety of applications in the dairy industry.

TECHNOLOGY

Current technologies being considered for commercialization include: *Brevibacteria* as a flavor adjunct for Cheddar cheese, enzyme technology to whiten skim milk, production of flavored cheese using high pressure injection technology, and the manufacture of specialty cheese from goat milk. Subsequent areas of interest are the use of textured whey proteins for use as a meat extender and whey permeate as an antioxidant in meat.

ACCOMPLISHMENTS

Two inventions were disclosed: one in the area of antioxidation properties of whey permeates in meat, and the other in the area of textured whey protein as a meat extender. A patent application was filed for the manufacture of lower-fat and fat-free pizza cheese. A new patent was issued for Center technology for a novel way of manufacturing mozzarella cheese. A license to produce and sell *Brevibacteria* was issued to **DSM Food Specialties**, Millville, Utah. A new company was started - **Shepherds Goat and Sheep Products**, LLC, Tooele, Utah.

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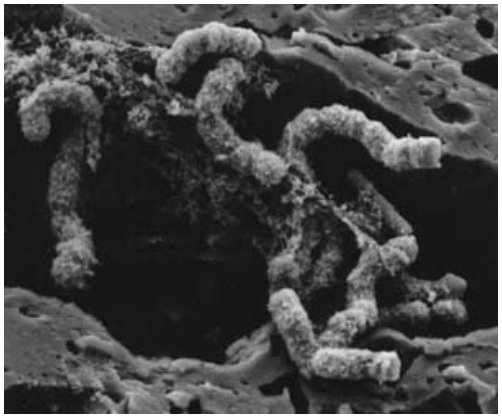
Can You Imagine...

... using low-fat or fat-free cheese in your pizza? Adding value to existing dairy products, e.g. whiter skim milk, flavors to cheeses; and new uses for dairy byproducts, eg. whey proteins?

THE CENTER COMMERCIALIZES TECHNOLOGIES DEVELOPED BY THE WESTERN DAIRY CENTER WHOSE RESEARCH IS FUNDED BY A CONSORTIUM OF FOOD COMPANIES.



Bacteria, in mozzarella cheese production.

CENTER FOR ELECTRONIC SYSTEMS TECHNOLOGY

CENTER

The Center for Electronic Systems and Technology, established in 1995, combines the expertise, resources, and capability of three universities--the University of Utah, BYU, and Utah State University--to serve the industrial community in electronic systems technology. The goal of the Center is to ensure that Utah industry can compete more effectively in the global market and to enhance the opportunities for Utah researchers to develop and commercialize their technologies.

TECHNOLOGY

Electronic systems technologies include microelectronics, digital electronics, RF, microwave, millimeter wave electronics, as well as optoelectronics. The Center provides research, design, evaluation, and prototyping services to Utah businesses that need specialized help in developing new products or enhancing market strengths. Services provided to industry include access to test equipment, laboratory testing, fundamental research and technology development, market analysis, personnel, information, and strategic planning.

ACCOMPLISHMENTS

Research contracts with a large number of technology-based companies have been signed and are in progress. The Center also provides a stream of new commercializable technologies that are being patented and offered for licensing to Utah companies. New opportunities include high-powered laser assemblies including a new 3-watt laser system, and new laser packaging technologies that could result in a new Utah laser manufacturing facility.

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Can You Imagine...

. . . a research and development center (including experienced researchers, engineers, world-class university facilities and expertise from Utah's three research universities) funded to provide a stream of new electronic technologies and support to Utah companies?

THROUGH IT'S STRONG INDUSTRIAL SUPPORT, THE CENTER IS EQUIPPED WITH STATE-OF-THE-ART CAPABILITY (SEE PICTURE) IN SEMICONDUCTOR TESTING. THESE CAPABILITIES ALLOW THE CENTER TO CONDUCT IT'S LEADING EDGE DEVELOPMENT AND PROVIDE SERVICE TO THE MICROELECTRONIC INDUSTRY.

■ CEST semiconductor testing facility

CENTER FOR HARSH ENVIRONMENT ELECTRONICS

CENTER

The Center for Harsh Environment Electronics (CHEE) was established in 1997 to develop novel, low-cost, easy to manufacture, high performance harsh environment electronics. CHEE's main focus is on electronic devices and circuits for operation in high temperature and harsh operating environments.

TECHNOLOGY

CHEE is focused on the development of harsh environment electronic systems such as gallium arsenide (GaAs)-based electronics that operate at high temperatures, vacuum microelectronics, and microminiature thermionic converters (MTCs) for thermal to electrical energy converters. The Center also provides services in the following areas: prototype development and testing; development of conventional and novel microelectronics and micromachined technologies; development of high temperature electronics, sensors, and systems; development tools to test and evaluate all types of microelectronics devices and systems ranging from memory technologies to flat panel display technologies; and work with industry (especially businesses located in Utah) in supporting their microelectronics and microfabrication technology needs. A new company was established to develop flat panel display technology.

ACCOMPLISHMENTS

The Center has been installing a pilot-line gallium arsenide (and other novel CHEE technologies) circuit fabrication facility that will be fully computer controlled when it comes on line in the near future. The pilot-line will greatly increase the reproducibility and reliability of prototype circuits produced as part of the CHEE's development activity. The evaluation of manufacturing issues for CHEE based electronics will be greatly enhanced by the new pilot-line facility. A highly promising and committed licensee has been identified and is attempting to negotiate with the University of Utah for license rights to selected applications of the CHEE technology suite. CHEE offers the most comprehensive microfabrication capability in the State of Utah and is committed to supporting the microfabrication and electronic testing needs of Utah businesses.

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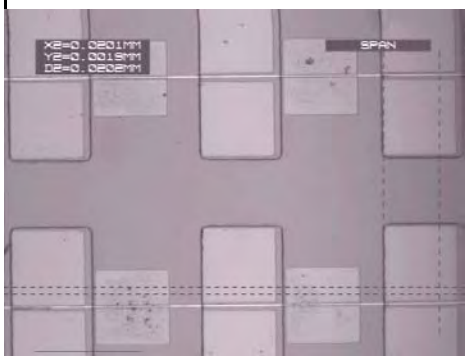
Can You Imagine...

. . . electronics that operate at "red hot" temperatures which are highly efficient, high speed, reliable, and can be mass produced at low cost?

THE CENTER EXPLORES ELECTRONIC CIRCUITRY THAT WILL OPERATE RELIABLY IN EXTREME HIGH TEMPERATURE ENVIRONMENTS.



The picture is an array of high temperature gallium arsenide (GaAs) metal emitter field effect transistors (MESFETs).

CENTER FOR INDUSTRIAL IMAGING

CENTER

The Center was established to commercialize image analysis, data analysis, and artificial intelligence technologies developed in the geosciences. Research at the University on fluid flow through porous media (i.e., aquifers, petroleum reservoirs) has resulted in generally useful image processing, image analysis, data analysis, and artificial intelligence techniques with commercial applications in geosciences and engineering.

TECHNOLOGY

Center technologies include Petrographic Image Analysis (PIA), which comprises four components: image acquisition, image processing, pattern recognition/data analysis, and linking to physical models. Each component involves specialized hardware, software, and expertise. The pattern recognition procedure within PIA has also proven useful in chemical fingerprinting in a variety of geoscience/environmental applications. The Center has begun to explore areas outside geoscience applications, including the application of PIA to medical imaging, and especially to automated screening of prostate biopsies. The Center also has been granted ownership of Integrated Paleontological System (IPS) software for further research, development, and commercialization. The Technical Alliance for Computational Stratigraphy (TACS), a consortium of nine petroleum companies, has been established to fund a three-year commercialization and development initiative.

ACCOMPLISHMENTS

GeoChem Metrix, Inc., was spun-off in September 1998. The company specializes in analysis of chemical data in the context of environmental and toxic tort litigation support. Two new software license agreements were signed with **BP-Amoco Upstream Technology** and **Elf Exploration Production** for the TACS consortium.

CONTACT

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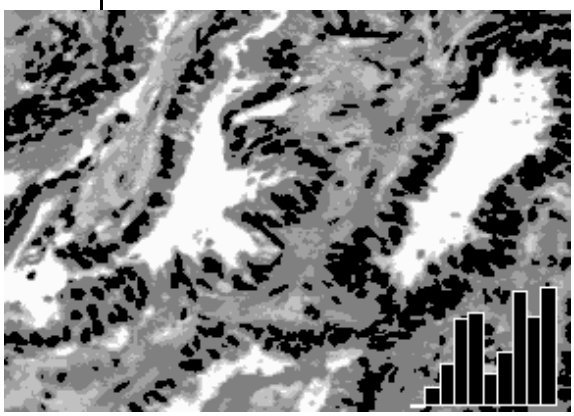
Can You Imagine...

. . . computational software that can automate the process of screening prostate biopsies and identifying suspected cancerous tissue using complex pattern recognition algorithms?

THE CENTER HAS DEVELOPED SOPHISTICATED SOFTWARE TO PROCESS DIGITAL IMAGES AND DO COMPLEX DATA ANALYSIS. COMMERCIAL APPLICATIONS INCLUDE BOTH GEOSCIENCE AND MEDICAL PRODUCTS



- Digitized image of prostate biopsy sample.
- Inset: histogram represents dominant morphologic fingerprint present in this sample.

CENTER FOR INTELLIGENT COMPUTER TOOLS

CENTER

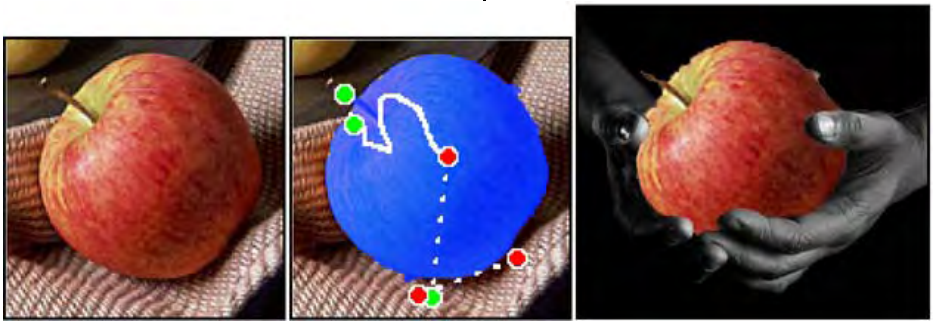
The Center for Intelligent Computer Tools was first funded in 1996 to facilitate the creation of computer tools including interactive image segmentation and composition, automated creation of digital (microfilm) libraries, and semi-automated creation of virtual environments from real world images.

TECHNOLOGY

The technology development effort is concentrated in the following areas: intelligent scissors / paint which performs image segmentation and composition; color quantization and dithering, which represents full color images with limited palette and no visual loss; resolution enhancement, making bad images good and good images better; document understanding – parsing document components and recognizing content; automated morphing between images for animation, video compression etc.; virtual environments to create realistic virtual environments from real world images and direct surface rendering.

ACCOMPLISHMENTS

Algorithms for intelligent paint segmentation and localization were refined. A prototype was developed for digital microfilm parser / browser. The intelligent scissors and color quantization software was licensed to Adobe Systems Inc. Adobe Systems has funded a significant research effort at CICT. The direct surface (Patch) rendering software was licensed to S3 Corporation. Currently, in the virtual environment development area the terrain database for the Virtual Olympics was expanded.



>Intelligent Paint starts by pressing the mouse button on one side of the object to be extracted(middle frame). The mouse is then dragged to the opposite side of the object and released. The "painted" object can then be pasted into another picture (right frame).

CONTACT

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Can You Imagine...

. . . careening down an Olympic bobsled run, fully aware of the twisting turns and angles of the sled, while watching the surrounding landscape rush by, all on the screen of your computer with every visual sensation artificially created in software.

THE CENTER DEVELOPS INTELLIGENT COMPUTER TOOLS FOR THE CREATION, MANIPULATION, AND PRESENTATION OF DIGITAL IMAGES.

CENTER FOR MINERALS TECHNOLOGY

CENTER

Established in 1995 the Center's focus is on developing new technologies for minerals processing. Specific areas of expertise include the design of high efficiency grinding mills using state of the art computer simulation software, advanced mill analysis and monitoring methods, technologies for the in-line monitoring and measurement of particle size on moving conveyor belts, and the real-time control of industrial milling processes.

TECHNOLOGY

Computer software, on-line instruments and laboratory procedures for the design, monitoring, control and analysis of industrial grinding machines and operating mineral recovery plants have been demonstrated and are now available for application in industry.

ACCOMPLISHMENTS

An instrument to measure the distribution of sizes of particles on moving conveyor belts has been developed and successfully tested at industrial sites. A key benefit is that it provides real-time process control for mining and milling operations. A laboratory on-line particle analysis system (**OPSA**) was installed at an industrial site for plant control by pellet characterization and has been licensed to several companies. **Millsoft™**, a grinding mill software, was sold to Process Engineering Resources, Inc., a Utah company. The program is made available for online access via the World Wide Web. To date, 13 licenses were sold during the fiscal year to industrial customers, who have benefitted significantly in terms of improved productivity. **MMIA** - an image analysis software for mineral liberation analysis has been developed to commercial standards. **MODSIM** is a modular simulator for ore dressing plants. Companies in Australia and Brazil have purchased licenses to use MMIA in their laboratories. A patent application for a dual drive planetary mill was filed. **Mineral Technologies Inc.** the spin-off company, continues to develop and market MODSIM and the image analysis software systems (including MMIA) for quantitative mineralogy and provides laboratory, analytical and consulting services. A new spin-off, **Milltech Engineering Co.,** was formed in Feb. 1999 (www.milltecheng.com). The company uses cutting edge modeling techniques and advanced simulation tools to devise practical solutions for problems.

CONTACT

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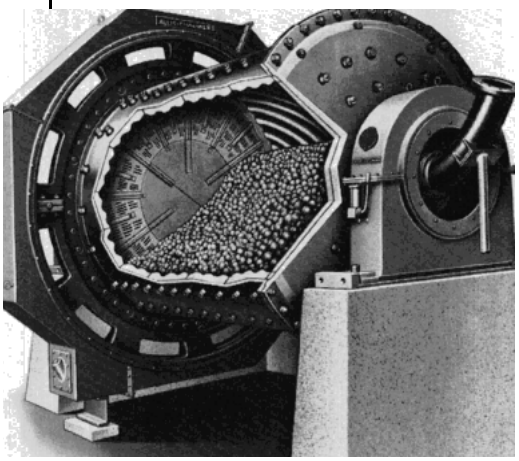
Can You Imagine...

. . . a tool which can observe milled materials traveling along a conveyor belt, calculate the average particle size and provide real time feedback to control and optimize the milling operation?

THE CENTER DEVELOPS LABORATORY AND COMPUTER SYSTEMS FOR OPTIMIZING PERFORMANCE AND MINIMIZING ENERGY CONSUMPTION IN INDUSTRIAL BALL MILLS WHICH ARE CENTRAL TO ALL MINERAL RECOVERY OPERATIONS.



- Typical ball mill grinding operation

CENTER FOR NEURAL INTERFACES

CENTER

Established in 1995, the Center transforms the neuroprosthetic technologies developed by the Moran Center for Applied Visual and Neural Science into prototype systems for the subsequent commercialization for use in neuroscience research and clinical application.

TECHNOLOGY

The Center has invented silicon-based arrays of microelectrodes that can either listen in on or talk directly to hundreds of neurons simultaneously. This can now be done on a chronic basis in awake and freely behaving animals. The Center has developed surgical tools and techniques that allow these high-density microelectrode arrays to be implanted in central and/or peripheral nervous systems. It has also developed data acquisition systems that permit the large amounts of data recorded by these microelectrode arrays to be stored and analyzed in PC-class computers. It has written software that is used to acquire and analyze these neural signals. The long-range goal of the Center is to use these new neural interfaces as therapies for disorders of the nervous system. Ultimately, these systems may provide limited, but functional sensory restoration in individuals with profound blindness or deafness, and enhanced motor function to individuals with high spinal cord injuries.

ACCOMPLISHMENTS

Five inventions were disclosed. Several prototypes from new inventions have been developed including a 16-channel field potential amplifier; completed pilot experiments with a 100-electrode array with varying length electrodes used to interface with the peripheral nervous system. A prototype of a high-density array (100 um sensor distance) was completed. Pilot studies of the human cortex in quadraplegic and paraplegic are in progress to validate the reorganization of the motor cortex following spinal injuries. **Bionic Technologies, Inc**., the Center spin-off company, has undertaken the commercialization effort of the prototypes developed at the Center to the international research community. Since its inception the company has already received three Phase I and two Phase II SBIR awards, a total of $1.7 million in federal support.

CONTACT

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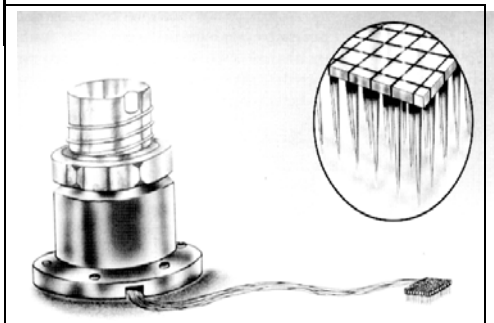
Can You Imagine...

. . . a miniature camera whose video output is fed to the visual cortex of a sight impaired person to provide artificial vision with sufficient resolution for key object identification?

THE CENTER WAS ESTABLISHED TO TRANSFORM THE NEUROPROSTHETIC TECHNOLOGIES DEVELOPED BY THE MORAN LABORATORIES FOR APPLIED VISUAL AND NEURAL SCIENCE INTO PROTOTYPE SYSTEMS FOR FUTURE CLINICAL APPLICATIONS.



The array probe and connecting cable assembly

CENTER FOR RAPID MICROBE DETECTION

CENTER

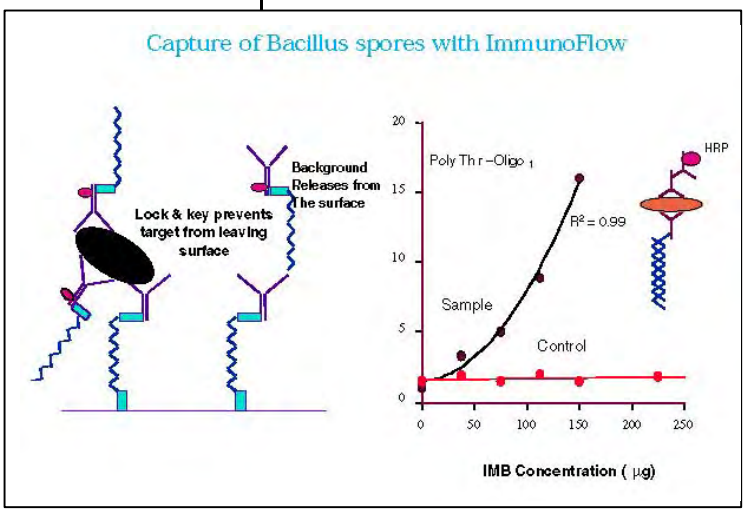
Established in 1998, the main goal of this Center is to develop technologies that lead to the real time detection of pathogenic microorganisms.

TECHNOLOGY

In order to detect specific pathogens in real time, novel pathogenic capture platforms and molecules have to be developed. The potential applications of the technology can span a number of industries including pharmaceutical, biotechnology, veterinary and biomedicine, agriculture, food processing, public health, defense, water and sewage treatment. Four technologies, each for a unique use or application, are being developed: ImmunoFlow, ImmunoDNA, GlycoBind and TissueTag. Each technology is volume independent and is expected to perform in both small and large volumes.

ACCOMPLISHMENTS

Prototypes have been developed for ImmunoFlow for two different microorganisms: *Bacillus globigii* spores and *E. coli* O157. The detection time for less than ten cells in tens of liters is 30 minutes. The Center received two patents for reconditioning antibiotic adulterated milk products and for the real time detection of antigens. A patent application has been submitted in the area of pathogen capture molecules and bench top detection with a unique chemical amplification system to increase signal.



CONTACT

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http://www.usu.edu/~realtime

Can You Imagine...

... being able to detect less than 10 cells of a specific pathogen strain in tens of liters of a processed liquid food, for example milk, within 30 minutes?

THE CENTER DEVELOPS TECHNOLOGIES FOR THE REAL TIME DETECTION AND QUANTIFICATION OF MICROORGANISMS, ESPECIALLY HARMFUL PATHOGENS.

- Capture of Bacillus spores and E.coli 0157 ImmunoFlow
- Capture DNA with Immuno DNA
- Capture of E.coli 0157, Listeria, and Salmonella with GlycoBind

CENTER FOR SCIENTIFIC COMPUTING AND IMAGING

CENTER

Scientific Computing and Imaging was created in 1996 to make available a commercial version of the SCIRun Software System. This is an interactive, visually based, scientific, engineering, and medical programming environment that allows the interactive construction, manipulation, and visualization of scientific and engineering simulations.

TECHNOLOGY

SCIRun technology provides scientists and engineers with a new model for scientific computing. The model relies on modern computing technologies such as graphical user interfaces and 3D graphics to provide a visual programming and problem-solving environment to investigate complex problems. The increased flexibility attempts to provide a "computational workbench" for scientific computing where experiments are formed, new methods explored, and tedious coding kept to a minimum.

ACCOMPLISHMENTS

A start-up company, **Visual Influence, Inc**., was created this year to develop products based on the SCIRun software system technology. The company has been granted license rights to specific fields of use, including medical imaging applications, in exchange for royalty payments and first rights of refusal on future application modules. The company is currently recruiting professional staff and is seeking venture investment capital. In addition, the Center has been approached by several other companies interested in license rights for specific applications and to develop specific technology oriented software packages based on the SCIRun technology. Administrators of the Center are Dr. Christopher Johnson, director, and Dr. Steven Parker, associate director. The Center also has been granted ownership of Integrated Paleontological System (IPS) software for further research, development, and commercialization. The Technical Alliance for Computational Stratigraphy (TACS), a consortium of nine petroleum companies, has been established to fund a three-year commercialization and development initiative.

CONTACT

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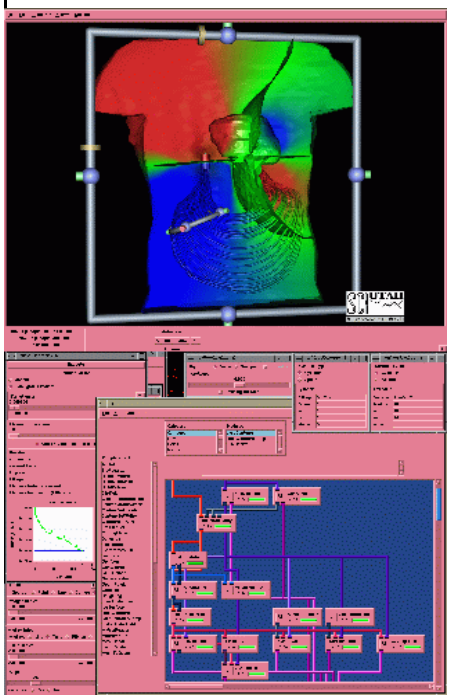
www.cs.utah.edu/sci

Can You Imagine...

. . . software that can create detailed, three-dimensional images of human arterial systems from raw MRI data and allow radiologists to rotate the images for complete diagnostic evaluation?

THE CENTER DEVELOPS SOPHISTICATED SOFTWARE THAT ALLOWS THE VISUALIZATION OF COMPLEX ENGINEERING AND SCIENTIFIC SIMULATIONS.



- Graphic shows an example SCIRun network, showing the dataflow programming interface, user interfaces for controlling simulation parameters, and results from a computer simulation of internal cardiac defibrillation.

CENTER FOR SELF-ORGANIZING & INTELLIGENT SYSTEMS

CENTER

The Center for Self-Organizing and Intelligent Systems (CSOIS) was first funded in 1993 to build on its core intelligent systems technology to develop commercializable products to the economic advantage of the state. The Center provides design services to Utah companies to develop intelligent systems solutions for new and improved commercial products. The Center maintains a national and international reputation as a leading contributor to the advancement of intelligent systems research.

TECHNOLOGY

Intelligent systems technology has grown to include virtually any device and/or software concept that attempts to artificially emulate the unique cognizance and control abilities of the human mind. Artificial neural networks are designed to mimic the ability of the brain and central nervous system to learn and generalize from past experience. Fuzzy logic was introduced as a way of emulating the reasoning processes fundamental to human intelligence. Virtual presence controllers attempt to place the remote human operator or controller in a virtual environment identical to that encountered by the controlled process. Neural control emulates the sensory and communication mechanisms of the human neural system.

ACCOMPLISHMENTS

The success of the Center in developing a unique *intelligent mobility* technology has resulted in significant recognition for the Center as a world leader in the design and application of unmanned ground vehicles (UGV's). These remotely controlled vehicles are uniquely suitable for use in agriculture, hazardous environment, and some military applications. During the past year, the Center was awarded a major Department of Defense UGV contract with enormous economic implications for the state. Consequently CSOIS was granted an unusual sixth year of funding support by the Centers of Excellence program to enable it to take advantage of this outstanding opportunity. A new spin-off company, **Visionary Products, Inc**., was created to pursue commercialization of the remotely controlled land-roving vehicle named Red Rover. A space hardened version of the rover will be a part of the next NASA Mars probe and will be available for children to remotely control on the surface of the planet Mars.

CONTACT

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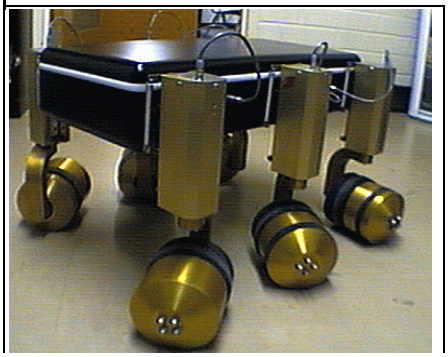
Can You Imagine...

. . . driving a remote mechanical rover across a Martian landscape, maneuvering around obstacles, retrieving soil samples, and pointing the rover camera in all directions to view the surrounding landscape, all from your personal computer.

THE CENTER INVESTIGATES ELECTRONIC AND SOFTWARE SYSTEMS THAT EMULATE THE LEARNING AND REASONING CAPABILITIES OF THE HUMAN MIND AND APPLIES THEM TO COMMERCIAL PRODUCTS.



- The newest rover, T1, which is the successor to the ARCIII

CENTER FOR SOLID OXIDE FUEL CELL TECHNOLOGY

CENTER

Established in 1996, the main focus of the Center is to develop solid oxide fuel cell (SOFC) technology for the direct conversion of chemical energy of a variety of fuels, such as natural or coal gas and other reformed logistic fuels, into electricity at a very high efficiency. Initially, the Center is developing cell stack technology for a 2 to 5 kilowatt unit, which has many potential applications with emphasis on distributed power for residential and remote locations for on-demand electrical power that is clean, efficient, reliable, and noise-free.

TECHNOLOGY

The Center technologies are based on the design and fabrication of novel, anode-supported solid oxide fuel cells with highly efficient electrodes that have a very low resistance. This concept makes it possible to develop a cost-effective, compact power unit for direct conversion of chemical energy of fuels into electricity for remote and residential applications.

ACCOMPLISHMENTS

Fuel cells that operate at lower temperatures (650 – 800^0C) but higher efficiency are being developed. The Center has been successful in attracting research and development grants from federal agencies as well as the Electric Power Research Institute (EPRI) and the Gas Research Institute (GRI). A low cost process for the fabrication of corrugated anode cell structure has been developed which allows the stacking of 4 to 6 cells. A consortium has been formed between University of Utah, EPRI, GRI and MSRI to pool the intellectual property of the partners to facilitate commercialization. MSRI was successful in receiving an ATP-NIST award for $3 million and the Center has received a subcontract from MSRI. The Center has filed four new patent applications.

CONTACT

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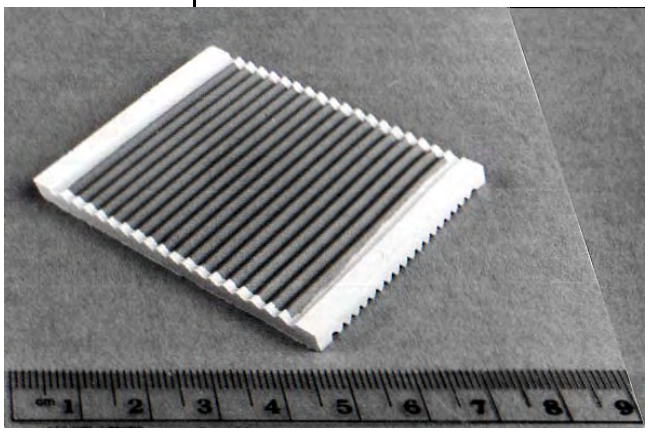
Can You Imagine...

. . . a portable generator you can take on your next camping trip that efficiently converts propane directly to electricity with no flame, no moving parts, no noise, and only water vapor as an exhaust pollutant?

THE CENTER EXPLORES COMMERCIALLY VIABLE METHODS OF CONVERTING GASEOUS FUELS DIRECTLY INTO ELECTRICITY USING HIGH EFFICIENT FUEL CELL TECHNOLOGIES.



- Photo of a 5cm x 5cm solid oxide fuel cell (SOFC) made by the center. The corrugations for the flow of fuel (e.g. natural gas) and oxidant (e.g.air) are in a cross-flow arrangement. The dark top surface is the cathode. SOFCs such as these are currently being configured into a stack. The objective is to construct a 2 to 5 kW stack for residential applications. The SOFC system will convert chemical energy of a variety of fuels into electricity.

V. APPENDICES

1. Financial Summary

2. Summary of Key Commercial Accomplishments

3. Summary of FY 1999-2000 Funded Centers

4. News Articles FY 1998-1999

BYU, U, Listed Among 5 Most Inventive Institutions

Technology Development Program Receives Funds

U's Supercomputer Is One Fast Thinker

Salt Lake City Company Gets Grant to Fund Cancer, Diabetes

Slow Start, But Genetics Firm Grows

Swell New Gel Designed in Utah

Virtual Olympics

Y. Team Constructing Virtual Venues

WSU Satellite to Ride Missile into Space

WSU Gives New Life to ICBM

5. Legislation Creating Centers of Excellence Program

Appendix 1

CENTERS OF EXCELLENCE - 1998/1999: FINANCIAL SUMMARY

	State Funding 1998/1999	Cumulative State Funding	Fed. Match 1998/1999	Indust. Match 1998/1999	Total Match 1998/1999	Cumulative Total Match
CENTERS FUNDED IN FISCAL 1998/1999:						
Advanced Structural Composites - BYU	$110,000	$110,000	$0	$393,973	$393,973	$393,973
Asynchronous Circuits - U/U	$115,000	$215,000	$300,000	$224,000	$524,000	$3,294,000
Biomolecular Technologies - U/U	$114,000	$114,000	$495,838	$0	$495,838	$495,838
Cell Signaling - U/U	$135,000	$260,000	$669,188	$195,757	$864,945	$5,639,445
Composites in Construction - U/U	$90,000	$90,000	$183,448	$31,953	$215,401	$215,401
Dairy Technology Commercialization - USU	$115,000	$115,000	$0	$829,463	$829,463	$829,463
Electronic Systems Technology - U/U	$175,000	$610,000	$0	$1,030,213	$1,030,213	$3,091,937
Harsh Environment Electronics - U/U	$160,000	$490,000	$0	$333,575	$333,575	$1,417,655
Industrial Imaging - U/U	$110,000	$420,000	$0	$571,892	$571,892	$1,817,280
Intelligent Computer Tools - BYU	$100,000	$295,000	$0	$545,498	$545,498	$1,708,267
Minerals Technology - U/U	$125,000	$480,000	$350,000	$83,197	$433,197	$1,495,485
Neural Interfaces - U/U	$140,000	$450,000	$57,512	$670,203	$727,715	$3,379,416
Rapid Microbe Detection - USU	$100,000	$100,000	$466,594	$318,235	$784,829	$784,829
Scientific Computing & Imaging - U/U	$140,000	$410,000	$622,121	$0	$622,121	$5,075,435
Self-Organizing & Intelligent Systems - USU	$125,000	$760,000	$2,550,000	$413,950	$2,963,950	$5,909,354
Solid Oxide Fuel Cells -U/U	$130,000	$330,000	$97,000	$340,000	$437,000	$1,158,397
Subtotals:	**$1,984,000**	**$5,249,000**	**$5,791,701**	**$5,981,910**	**$11,773,610**	**$36,706,175**
CENTERS NOT FUNDED IN FISCAL 1998/1999:						
All Graduated Centers		$19,574,655				$148,917,481
All Distingushed Centers		$5,890,440				$147,118,784
TOTALS:		**$30,714,095**	**$5,791,701**	**$5,981,910**	**$11,773,610**	**$332,742,440**
1998/1999 MATCHING RATIO	**5.9 : 1**					
CUMULATIVE MATCHING RATIO	**10.8 : 1**					

Appendix 2

CENTERS OF EXCELLENCE - 1998/1999: Summary of Key Commercial Accomplishments

	Spin-Off Companies		Companies	Patents/Copyrights		Licenses
	New	Total	Assisted	Pending	Issued	Signed
CENTERS FUNDED IN FISCAL 1998/1999:						
Advanced Structural Composites - BYU	1	1	25	1	1	1
Asynchronous Circuits - U/U	0	0	7	1	0	0
Biomolecular Technologies - U/U	0	0	0	0	0	0
Cell Signaling - U/U	1	2	11	7	0	2
Composites in Construction - U/U	0	0	20	1	0	0
Dairy Technology Commercialization - USU	1	1	5	3	1	1
Electronic Systems Technology - U/U	0	2	12	3	1	1
Harsh Environment Electronics - U/U	0	1	5	12	2	1
Industrial Imaging - U/U	1	1	34	0	0	2
Intelligent Computer Tools - BYU	0	0	6	0	0	2
Minerals Technology - U/U	1	2	3	1	0	3
Neural Interfaces - U/U	0	1	40	5	2	2
Rapid Microbe Detection - USU	0	0	10	1	2	2
Scientific Computing & Imaging - U/U	1	1	0	0	0	1
Self-Organizing & Intelligent Systems - USU	0	2	10	0	5	3
Solid Oxide Fuel Cells -U/U	0	0	6	4	1	0
Subtotals:	6	14	194	39	15	21
CENTERS NOT FUNDED IN FISCAL 1998/1999:						
All Graduated Centers		96	600		53	67
All Distinguished Centers		22	191		33	87
TOTALS:	**6**	**132**	**985**	**39**	**101**	**175**

Notes:

1. There are an estimated 1300 persons employed at companies that trace their origins to the Utah Centers of Excellence Program
2. Industry surveys indicate that the average salaries for these high technology sector jobs in Utah exceeds $45,000 per year

SUMMARY OF 1999-2000 Funded Centers

The **Centers of Excellence Program** was established in 1986 to encourage the commercialization of leading-edge technology developed at Utah's universities and colleges by funding late-stage research and early product-development activities. The following Centers have been approved for funding during the 1999-2000 fiscal year. A complete summary of their accomplishments will be published in the Annual Report to the Legislature in October 2000.

CENTER	P.I.	Inst	Contact Numbers	Brief Description
Advanced Machining and Joining	Tracy Nelson	BYU	(801) 378-6233 Fax (801) 378-7575	Focuses on the development of tools and processes using an advanced joining technology called "friction stir welding."
Advanced Structural Composites	David Jensen	BYU	(801) 378-2094 Fax (801) 378-4449 david@byu.edu	Develop the commercial products for the integration of damping materials with composites and the creation of lightweight composite materials.
Asynchronous Circuit and System Design	Chris Myers Erik Brunvand	U/U	(801) 581-6490 Fax (801) 581-5281 myers@ee.utah.edu (801) 581-4345 Fax (801) 581-5843 elb@cs.utah.edu	Facilitates the systematic asynchronous and self-timed computer-assisted design tools into viable commercial products.
Biomedical Optics	Werner Gellerman	U/U	(801) 581-5222 Fax (801) 581-4801 Werner@mail.physics.utah.edu	Develop and commercialize optical technologies for diagnostic and therapeutic treatments.
Biomolecular Technologies	Tore Straume	U/U	(801) 581-6853 f. (801) 581-7008 t.straume@m.cc.utah.edu	Commercialize new technologies for the separation of nucleic acid sequences with rearrangements and the positioning of biomolecules on surfaces.
Cell Signaling	Glenn Prestwich	U/U	(801) 581-7063 Fax (801) 581-7087 gprestwich@deans.pharm.utah.edu	Focused on technologies important to the treatment of cancer, allergy, asthma, and inflammation. Near-term products for commercialization include chemical agents developed in the center.
Compliant Mechanisms	Larry Howell	BYU	(801)378-8037 Fax (801) 378-5037 lhowell@et.byu.edu	Based on proprietary design techniques used to reduce the complexity and parts count of conventional mechanical designs.
Dairy Technology Commercialization	Carl Brothersen	USU	(435) 797-3466 f. (435) 797-2379 wcdprt@cc.usu.edu	Commercialize technologies developed at the Western Dairy Center, USU, including cheese starter cultures, cheese flavor, cheese technology, and whey processing.
Electronic Medical Education	Ric Harnsberger	U/U	(801) 581-4624 Fax (801) 581-3222 Ric.harnsberger@hsc.utah.edu	Creation of medical education products for delivery over the internet, including interdepartmental digital teaching files, patient support and community outreach services.

Harsh Environment Electronics (Formerly MTV Flat Panel Displays)	Laurence Sadwick	U/U	(801) 581-8282 Fax (801) 581-5281 sadwick@ee.utah.edu	Makes low-cost, high yield microminiature thermionic vacuum emitters to perform the function of cathode ray tubes and matrix liquid crystal displays. Commercializing technologies related to high-speed digital and analog high-power and microwave electronics, microminiature thermionic converters, and flat-panel displays.
Intelligent Computer Tools	Bill Barrett	BYU	(801) 378-7430 Fax (801) 378-7775 barrett@cs.byu.edu	Applies the use of intelligent computer tools for digital image composition, digital library creation, and creation of an interaction with virtual environments.
Neural Interfaces	Richard Normann	U/U	(801) 581-7645 Fax (801) 581-8966 normann@cc.utah.edu	Developing neuroprosthetic systems that will provide the restoration of limited sensation to the profoundly blind or deaf or to provide enhanced interaction of quadriplegics with their environment. A company has been formed to manufacture and distribute research tools.
Rapid Microbe Detection	Bart Weimer	USU	(435) 797-3356 Fax (435) 797-2379 milkbugs@cc.usu.edu	Using immunoflow technology to detect contaminating microbes rapidly, to enhance real time decisions in several industries including food, pharmaceutical and public health.
Scientific Computing and Imaging	Christopher Johnson	U/U	(801) 581-7705 Fax (801) 581-5843 crj@cs.utah.edu	Commercialization of the SCIRun Software System, a visually-based programming environment that allows the interactive construction, manipulation, and visualization of scientific and engineering simulations.
Self-Organizing & Intelligent Systems	Kevin L. Moore	USU	(801) 797-2924 Fax (801) 797-3054 moorek@ece.usu.edu	Helps Utah industry develop marketable products using the technology of self-organizing intelligent systems and to establish itself as a world leader in intelligent systems research.
Solid Oxide Fuel Cell	Anil Virkar	U/U	(801) 581-5396 Fax (801) 581-4816 anil.virkar@m.cc.utah.edu	Researches electrochemical devices that can convert natural gas or hydrogen, directly into electricity at very high efficiencies.

For more information: *Centers of Excellence Program*
Department of Community and Economic Development
324 South State Street, Suite 500, Salt Lake City, Utah 84111
(801) 538-8770, Fax (801) 538-8773
E-mail: ecox@dced.state.ut.us - Web site: http://www.dced.state.ut.us/techdev

News Article
Utah's Technology Transfer Programs

Deseret News
Thursday, February 11, 1999

BYU, U. listed among 5 most 'inventive' institutions

By Joel Campbell Deseret News associate business editor

Brigham Young University and the University of Utah are among the five most "inventive" North American research institutions. That is, they're among the best at turning research dollars into potentially marketable technology.

According to analysis by Technology Access Report, a newsletter based in Novato, Calif., that specializes in technology transfer, BYU ranks No. 1 and the University of Utah No. 4 among research institutions in a comparison of six factors. Those factors include: startup companies spun off of university research, licenses executed, new patents applied for, research funding related to a license, total industrial funding and licensing income. The most recent data compared are from 1996.

Monthly newsletter editor Michael Odza created a ratio comparing total research dollars pumped into an institution with the functions associated with a successful technology transfer program.

Although BYU has a relatively small influx of research dollars -- $15.4 million -- the university came on top for its conversion of research into technology licenses or patents. BYU was followed by University of Akron, University of Alberta and Queen's University. The University of Utah -- with a research budget of $163 million in 1996 -- came in fourth.

He said the numbers speak well for the pair of universities, which are not located in traditional technology transfer hubs, such as those on the East or West Coast. "Even though the ratio device favors smaller institutions and hospitals which don't receive much research and development funding, it is reassuring to see that tech transfer power houses like Utah, Rutgers and Massachusetts Institute of Technology are in or near the top," Odza said.

Odza commended what appears to be a "critical mass" of business, capital and research capability to have such a solid technology transfer record in Utah. In particular, software and medical devices are strengths for technology transfer here. Although not in the top 50, Odza also said Utah State University also has a good record for technology transfer.

Utah also has a nascent crop of biotechnology companies that can trace their beginnings to university research.

The state universities' technology transfer prowess has been assisted by the Utah Centers of Excellence program. "The Centers of Excellence Program continues to be one of the nation's successful technology commercialization programs as measured by matching dollars, significant new commercialized products and state economic impact," said Rod Linton, director of the program. The program was formed in 1986.

The Salt Lake Tribune
April 20, 1999

Technology Development Program Receives Funds

Utah's Centers of Excellence program will receive nearly $1.9 million for its fiscal year 2000 from the Utah Division of Business and Economic Development.

The program aims to encourage the commercialization of technologies created at Utah colleges and universities by helping form new companies. The funding will support 14 university-based centers. Eight centers were not funded.

Those receiving funding include four Brigham Young University Centers: Advanced Machining and Joining, Compliant Mechanisms and Advanced Structural Composites, which received $110,000 each; and Intelligent Computer Tools, which received $125,000.

Eight University of Utah centers also were funded. They are: Biomedical Optics and Electronic Medical Education, which received $120,000 each; Asynchronous Circuit Design and Biomolecular Technology, which received $130,000 each; Cell Signaling ($175,000); Harsh Environment Electronics ($180,000); Neural Interfaces ($150,000); and Solid Oxide Fuel-Cell Technology ($165,000).

Two Utah State University centers that also received money were Dairy Technology ($120,000) and Rapid Detection of Microbes ($150,000).

The Centers of Excellence program has helped form more than 100 businesses and create more than 1,000 jobs since it was created in 1986.

The Salt Lake Tribune
TECH CONNECTION
SATURDAY, June 26, 1999
D-9

U.'s Supercomputer Is One Fast Thinker

$4.5 million unit is among top 500 in the world

BY VINCE HORIUCHI
THE SALT LAKE TRIBUNE

The University of Utah's $4.5 million supercomputer may not toast bread, but it can solve math problems lickety-split.

How fast? Try 41 billion calculations each second.

"Our computer is capable of 41 GIGAFLOPS or floating point operations per second," said Chris Johnson, associate professor and director of the University of Utah's Center for Scientific Computing and Imaging. "That's a lot."

In fact, the Onyx2 Reality Monster is so speedy, it is among the top 500 most-powerful computers in the world, according to two professors who rate the world's top supercomputer sites. The university's computer is the backbone of its SGI-UtahVisual Supercomputing Center.

"We're the only place in Utah on the list. And if you look on the list, there aren't a lot of universities."

Chris Johnson
On the U.'s supercomputer

Hans Meuer of the University of Mannheim in Germany and Jack Dongarra of the University of Tennesee at Knoxville put out their Top 500 supercomputer list twice a year. See it at **www.top500.org.**

Their newest list, released last week, puts the U of U's computer at No. 353, slightly behind America Online's computer, but ahead of the computer that holds the database for the Library of Congress.

Dongarra said he compiles his list for manufacturers and other potential supercomputer users. "Such statistics can facilitate the establishment of collaborations and the exchange of data and software," he said.

At the top of the latest list is the ASCI Red TFLOPS Supercomputer at the Sandia National Laboratories in Albuquerque, N.M. The facility, which is under the auspices of the U.S. Department of Energy, uses its computer to simulate the physics of nuclear blasts without having to do underground testing.

To give an idea of how fast its computer is, Sandia describes it like this: "It would take every man, woman and child in the United States, working nonstop with hand calculators over 125 years, to equal what this computer can do in one second."

Supercomputers involve many processors that work together and are used to do dense geometry or physics calculations to simulate all kinds of real-world events. They are thousands of times more powerful than a regular desktop computer.

"If we say the speed of a new home PC [is like] traveling in a car across the country in two days, then the supercomputer would make that same distance in 15 seconds," Dongarra said.

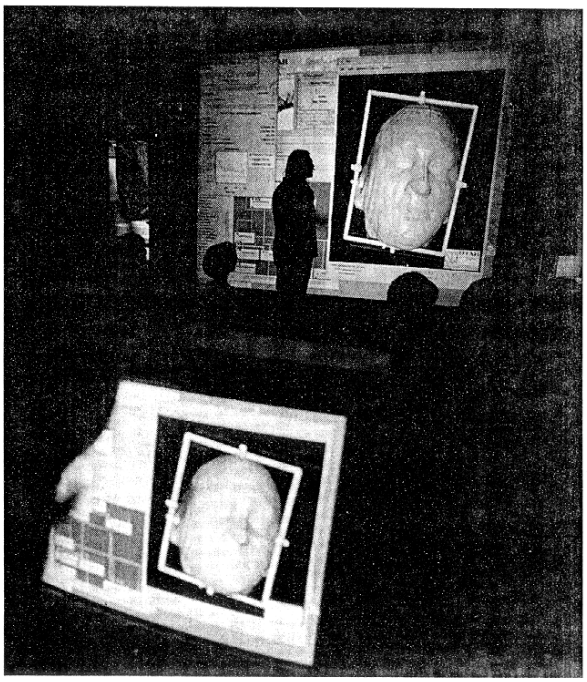
The U of U bought its machine from Silicon Graphics (which, incidentally, was founded by U. computer science graduate Jim Clark) for less than half price two years ago.

It is used as a research computer by many of the school's departments and calculates information for many simulations, including for medical research, searches for oil deposits or to design better buildings.

Earlier this month, the university installed 32 more processors for a total of 96. The computer has 16 gigabytes of random access memory or RAM, 250,000 times more than what is in a regular desktop computer.

It also has more than 200 gigabytes of harddrive space. It is the size of eight refrigerators stacked side by side.

"As we start to try and do more complicated things, you need more and more computing power," Johnson said. "We're the only place in Utah on the list. And if you look on the list, there aren't a lot of universities."



Steve Griffin/The Salt Lake Tribune

Chris Johnson stands in front of a big screen during a demonstration of the University of Utah's Center for Scientific Computing and Imaging.

The Enterprise
July 5, 1999

Salt Lake company gets grant to fund cancer, diabetes research

Salt Lake City-based Echelon Research Laboratories Inc. has been awarded a two-year, more than $500,000 Small Business Technology Transfer Phase II grant from the National Institutes of Health to develop specific cell signaling assays expected to be valuable in the study of cancer and diabetes.

Dr. Glenn D. Prestwich, vice president of research, will be the principal investigator for the project. Dr. Prestwich also is presidential professor and chairman of the Dept. of Medicinal Chemistry at the University of Utah.

Echelon Research was formed in 1997 and specializes in chemicals shown to play a critical role in the processes by which cells communicate. In April 1998 the firm began distributing specific cell signaling products to scientists in the U.S., Europe and Asia.

The company plans to develop assays for early cancer detection and for determining the potential of specific cancer cells to metastasize. Each assay employs reagents uniquely produced by Echelon. Biochemists at the firm have already been successful in developing antibodies to several molecules.

Echelon is located in Research Park adjacent to the University of Utah and is affiliated with the Center for Cell Signaling, a center of excellence program started by the State of Utah to foster the development of technology.

News Article
Myriad Genetics
A Spin-off from the Center for Cancer Genetics

Slow Start, But Genetics Firm Grows

BY GUY BOULTON
THE SALT LAKE TRIBUNE

They call it the "burn rate" — the speed at which young companies burn through cash — and Myriad Genetics Inc.'s rate has slowed.

The biotechnology company, based in Salt Lake City, last week announced a research partnership with Novartis Agricultural Discovery Institute worth $33.5 million over the next two years.

Novartis is paying Myriad to research the genetic makeup of cereal crops, such as rice, maize, wheat, barley and oats. The goal is to identify genes that could be used to improve crop yields, such as genes that make crops more resistant to drought or disease.

Myriad has struck similar agreements with pharmaceutical companies to identify genes linked to specific diseases, but the Novartis deal was its first research agreement for agriculture.

The agreement is another indication that companies will pay Myriad for its expertise. That is one of the pillars of the company's business plan.

Biotechnology requires patience and money. To survive, companies and their investors need plenty of both. That's why the "burn rate" becomes all important.

"They are doing a good job keeping their burn rate fairly modest," said Eric Schmidt, an analyst with SG Cowen & Co. "This company doesn't spend a lot of money. Most of the [research-and-development] costs are off-loaded to partners."

Myriad, which netted $50 million in a stock offering in 1995, had $38.9 million in cash and investments as of June 30.

The company, founded in 1991, employs about 270 people at Research Park near the University of Utah.

Wall Street analysts project Myriad will have revenue of $33.5 million in its fiscal year ending June 30. That's up from revenue of $25.3 million in its 1999 fiscal year.

The company isn't profitable. It lost $10 million in its last fiscal year.

But Myriad also is earning money on genetic testing it does for physicians and hospitals. The tests are for a gene linked to breast cancer.

See **MYRIAD**, Page **B-5**

Leah Hogsten/The Salt

Researcher Andrea Slade prepares a gel plate for DNA sequencing in a laboratory of Myriad Genetics Inc. Myriad, located in Res tests gene sequencing to help develop target drugs for cancer and other diseases, and recently landed its first agricultural contr

Myriad Burns Cash Less Quickly

Continued from **B-1**

After a slow start, the business is growing. Testing revenue more than doubled to $5.2 million in the company's 1999 fiscal year. And Schmidt expects Myriad to be profitable in its 2001 fiscal year.

On Thursday, the company announced the discovery of a gene involved in the inherited susceptibility to insulin-dependent diabetes.

The gene's discovery offers the opportunity to develop drugs to prevent or to slow the progression of diabetes, creating other potential revenue sources, the company said in a statement.

Novartis is paying Myriad to map the genetic sequence of crops.

Myriad must build a new lab for the contract. But the tab will be picked up by Novartis. And Myriad will own the equipment.

"They are not really paying for much of the investment," Schmidt said.

Myriad expects to hire about 30 people. "We think we can find almost all of them right here," spokesman William Hockett said.

And Myriad expects the contract to be extended beyond two years.

Controversy surrounds the push to develop genetically altered versions of crops. Critics fear the potential ecological consequences. Proponents contend that any hybrid is genetically altered. They also contend it can reduce the need for pesticide and fertilizer.

Using biotechnology to develop new crops also can take years. Myriad, though, gets paid up front. It won't get a royalty, for instance, if the research produces a hardier strain of oats. It will get 50 percent of the profits if the data is sold to another company.

"But what is developed from that is not relative to Myriad," Hockett said.

Swell New Gel Designed In Utah Could Change Drug Delivery

BY LEE SIEGEL
THE SALT LAKE TRIBUNE

Jindrich Kopecek is among the University of Utah bioengineers developing new hybrid hydrogels. (Rick Egan/ The Salt Lake Tribune)

University of Utah bioengineers have developed new gelatinous materials that can be designed to release medicines when and where needed in the body. The materials also someday may be used as "artificial muscles" to run valves, switches and other mechanical devices.

The new kind of "hybrid hydrogels" are more sophisticated than simple hydrogels now used in soft contact lenses, time-release medicines and nicotine patches.

The gels created at the university are "smart materials" that can be designed to suddenly swell or shrink in response to changes in temperature, acidity, salinity, sugar levels, mechanical stress or other factors.

Development of the new hydrogels was reported in today's issue of the journal Nature by Jindrich (Henry) Kopecek, the U.'s chairman of pharmaceutics and pharmaceutical chemistry; Russell Stewart, an assistant professor of bioengineering; and Chun Wang, a bioengineering graduate student.

Hydrogels traditionally consist of a network of polymers -- large chains of identical molecules -- that are linked together so they swell in water but do not dissolve.

The Utah researchers developed hydrogels in which the traditional synthetic polymers are linked to genetically engineered, coil-shaped pieces of protein molecules.

"We are using materials from biology and combining them with synthetic materials to create a new class of materials," Stewart said.

The two new hydrogels created at the U. swell in water because water makes the protein coils expand. When the gels are heated to certain temperatures -- about 104 degrees Fahrenheit for one gel and above water's 212-degree boiling point for the other -- the molecular coils collapse. As a result, the gel abruptly shrinks to 10 percent of its volume, expelling the water and any medicine the gel carries.

The study shows it is possible to design hydrogels to shrink or swell in response to a variety of environmental conditions.

One of the U.'s temperature-sensitive hydrogels might carry an anti-fever medicine. It would be given to someone with an infection likely to cause a fever. If the person got a fever, the heat would make the gel collapse and expel the medicine.

Or, said Kopecek, a hybrid hydrogel might be designed to carry insulin and an enzyme. The gel could be implanted under the skin of a diabetic patient. When blood sugar rises to unsafe levels, some sugar penetrates the gel, where the enzyme converts the sugar to acid. The acid makes the gel expand and become porous so insulin is released from the gel and reduces the patient's blood sugar.

For diabetics on insulin, "you have to deliver the accurate amount at the right time, then stop until you need it the next time," said Kinam Park, a pharmaceutics professor at Purdue University in Indiana. "Kopecek's approach provides one more step toward achieving that goal."

Park said conventional polymer hydrogels are used in some time-release pills and capsules and in skin patches that release nicotine to help smokers quit cigarettes. Those hydrogels release medication only at a certain time or certain rate, not precisely when needed, he added.

The new hydrogels will allow "self-regulated drug delivery," releasing medicine in response to changing conditions in the body, he said.

Polymers in existing hydrogels are easy to make and are "biocompatible" so they rarely cause harmful

reactions in patients. But their properties are limited. Kopecek's team combines them with protein fragments that have known properties, such as the coil-shaped molecules that collapse at a certain temperature. That gives the hybrid hydrogel the same property.

Some previous conventional hydrogels swelled or shrank at certain fixed temperatures simply because the polymers in them do the same thing. By creating a hybrid with genetically engineered protein fragments, a hydrogel can be designed to shrink or swell at just about any desired temperature, Stewart said.

Because there are countless proteins in the body, each with its own function, "we can make a smart hydrogel with any property we want," Park said. "Kopecek has opened up a whole new area of smart hydrogels. This provides a new approach to tailor-make a smart hydrogel for any specific application."

Kopecek said: "You can mimic Mother Nature by designing new materials which contain only a small part of natural materials, but behave as materials developed by Mother Nature."

The university is seeking to patent the hybrid hydrogels, he added.

Kopecek said hybrid hydrogels might be designed to work as artificial muscles -- not as replacements for real muscles, but to swell or shrink so they could open or close valves and other mechanical devices.

For example, a hydrogel might be used in sensors for toxic pollutants, he said. The gel could contain a substance that binds to a pollutant. When the pollutant is present, the gel in the sensor reacts with it, expands and sets off an alarm.

Kopecek said hydrogels and soft contact lenses first were designed in the late 1950s and early 1960s by his doctoral advisers when he was a student in Prague: Drahoslav Lim and the late Otto Wichterle of the Czechoslovak Academy of Sciences.

Stewart and Kopecek said hydrogels also are used to give thickness to some shampoos and in laboratory devices that separate substances into components of different molecular weights.

Kopecek now is conducting another study of a polymer that is not a hydrogel but is used to make them. The polymer is bound to an anticancer drug and an antibody that recognizes cancer cells. That lets the hydrogel carry the drug only into cancer cells without targeting other cells, allowing doctors to administer higher doses without as many toxic effects on patients.

Deseret News

Comics
Dear Abby
Reviews
Television

MARILYN KARRAS, FEATURE EDITOR, 237-2150

SCIENCE
TECHNOLOGY

VIRTUAL Olympics

3-D model will welcome the world to Utah on the Web

By Steve Fidel
Deseret News staff writer

2002 OLYMPICS

A "Virtual Olympics" project at Brigham Young University aims to boost interest in the 2002 Winter Games by creating an interactive, virtual model of the Wasatch Front.

Over the Internet, people could see northern Utah's spectacular mountain terrain and zoom in on specific Olympic venues and their surroundings.

Want to see how close a chosen hotel really is to the slopes? The 3-D model would let you look at the building and its surroundings. Want to run the actual course of an Olympic ski event? Users could do that too in a simulation that gives the sensation of soaring through the air or down the slopes.'

"Users from all over the world will be able to see for themselves what Park City's ski runs and Provo's skating rink look like," said William Barrett, chairman of BYU's computer science department.

Computer science faculty and students have been working on the simulation for more than a year by combining topical information and aerial photographs taken by the U.S. Geological Survey.

"Students entered the elevation information into the computer as points and draped the photos over the top of them," said Barrett. "This might be oversimplifying, but it was kind of like building a 3-D model out of chicken wire and fitting a cloth over the top of it."

The computer program is funded by a state partnership program called the Center for Excellence. The project is not a sanctioned component of the 2002 Winter Games but it does have state support and is emphasizing its virtual access to Olympic venues. Programmers have also made it possible to visit other Wasatch Front locations as well, like taking a simulated hike to the summit of Mount Timpanogos or a tour of Salt Lake City's Temple Square.

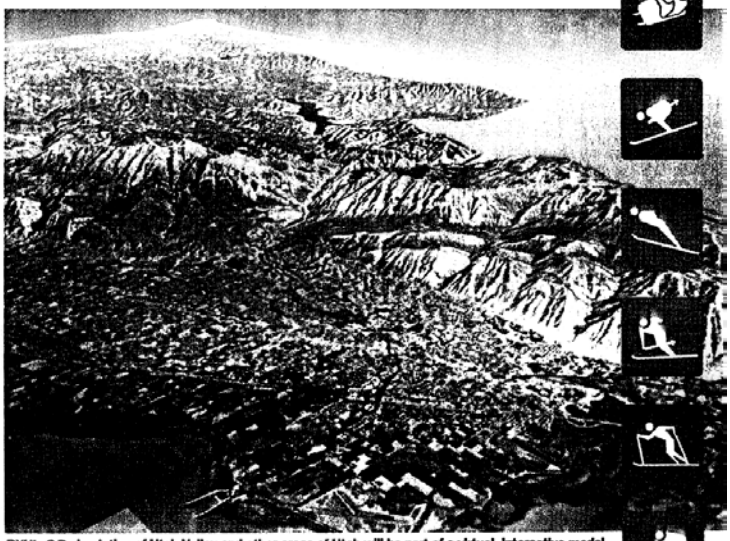
Observers who have seen the program like to look for their own house and often search out unique landmarks familiar to them, like little-known mountain trails. "The aerial imagery is good enough you can see actual mountain trails," Barrett said.

The project won state funding because of its promise for commercial applications. Video game companies Single Trac and Viewpoint have helped fund the Center of Excellence and have an interest in applications of the program. Barrett said the program's graphics should also be of interest to television networks that want quick access to Wasatch Front visuals, especially for Olympic coverage.

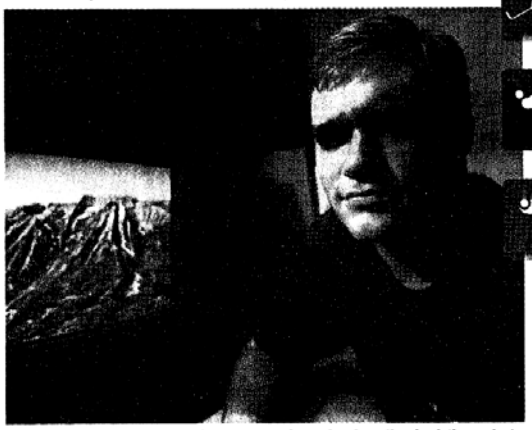
Parris Egbert, an associate professor of computer science who directs student work on the project, said Virtual Olympics has given students the chance to gain invaluable programming experience. Unique questions that arise as students work on Virtual Olympics quickly turn into areas of further scholarly research. "By the time this thing is all through, we'll probably have four or five master's theses completed and at least one doctorate," Egbert said.

Brian Zaugg, a master's student in computer science who currently heads up the project, plans to base his thesis on the unique challenges encountered while trying to make the program run faster and more efficiently. "Most class projects are small and seem like they're over too soon. But Virtual Olympics is so much you almost don't know how to do it all. It's been really educational to work on a project this big."

Barrett estimates another year will pass before outsiders see the finished product. "We first got it running on a high-end graphics computer. It's now running on a PC, which was our target. Now we're saying, 'How far can we push the PC level?'"



BYU's 3-D simulation of Utah Valley and other areas of Utah will be part of a virtual, interactive model.



Brian Zaugg, a master's student in computer science, heads up the simulation project.

The Salt Lake Tribune
TECH CONNECTION
SATURDAY, SEPTEMBER 4, 1999
Page D-9

Y. Team Constructing Virtual Venues

Mountains of data are reproducing mountains of Utah to acquaint Olympic fans with the area

BY VINCE HORIUCHI
THE SALT LAKE TRIBUNE

PROVO — Eight Brigham Young University students want to take everyone to the 2002 Olympic Winter Games for free. Well, sort of.

This group of computer whizzes is re-creating the Wasatch Front in bits and bytes and packing it into a Silicon Graphics computer at the school. All 11 competition venues and other Olympic sites from Provo to Snowbasin ski resort are included in the computer model, and users will be able to "fly" over and into the buildings.

"The idea is to put on the Internet a site where people can go and attend the Olympics virtually," said Parris Egbert, a BYU associate professor of computer science who is heading the student project. "They can ski down the runs on their computer, look at the bobsled runs, go to the ice rinks and see what they look like inside."

In six months to a year, they should have a working version available where anyone can log onto the site and be able to view the cities and venues with 360 degrees of movement. The students also hope to sell the idea to the Salt Lake Organizing Committee or other associations that can make the program available at information kiosks in Salt Lake City hotels and Olympic venues.

"People traveling to Utah can go there and look at the model of Salt Lake, go to their hotel and go to the venues, take a tour of downtown Salt Lake or the canyons," Egbert said. "We want to make it available to everybody."

The Virtual Olympics Project began nearly two years ago when the school's Advanced 3D Graphics Lab was working on another virtual environment and thought it would be fun to focus on the Olympic venues, Egbert said.

The first step involved getting actual elevation data and black-and-white photographs of the Salt Lake Valley from the U.S. Geological Survey office and turning them into a computer terrain model.

Using those elevation figures — which represent the dips and bumps in the terrain — students created a "wire-frame" model or grid of the mountainous valley in the computer. The black-and-white photos were then transferred digitally into patches called textures. The textures were colored and then pasted onto the wire frame, resulting in photo-realistic terrain. The ground data files are so huge, they so far takes up nearly 16 gigabytes (that's 16 billion bytes of hard-drive space or about 35 CD-ROMs).

Graduate student Brian Zaugg heads the project and is responsible for making it run smoothly on most of today's computers.

"We're hoping that in six months, you'll get good frame rates [number of frames per second] on an average person's computer," he said.

Meanwhile, graduate student Alan Cheney has spent the past two weeks designing nothing but trees. He took pictures of some evergreens outside the computer-department building and converted them into textures for small trees that will dot the terrain.

"We're trying to get trees in the program that are three-dimensional so you can go past them, and they look fairly realistic," said Cheney, 24.

The team also created a software program that can play or display the terrain on a computer. A person would have to download this small software player first in order to view the terrain.

"In areas of interest, you'll be able to zoom in pretty close," said Zaugg, 26, who wants to make video games for a living when he graduates. "If we wanted to, we could zoom down to the microscopic level, but that would require huge amounts of data."

The group hopes its project, which has cost more than $60,000 so far, will attract an outside buyer. Though the students might have a working version available in six months, they expect it to be an ongoing research project for a few more years.

The project was financed through state government's Utah Center of Excellence program, which funds projects for commercial ventures. So far, two Utah companies, video-game developer Single Trac, and 3-D computer model maker Viewpoint DataLabs, have expressed interest in BYU's work, said Egbert.

"The idea is once we get this thing rolling, then we can turn it into a commercial project," Egbert said. "We run into so many people who want to see it. When we tell them about it, they want to take home a demo."

Leah Hogsten /The Salt Lake Tribune

BYU student Brian Zaugg, left, and Associate Professor Parris Egbert, are part of a team working on virtual representations of Utah Olympic sites. The representations will be available on the Internet. The screens show Olympic runs at Deer Valley.

Standard-Examiner
September 18, 1999

WSU satellite to ride missile into space

☐ Unique delivery system to take advantage of former Cold War weapon

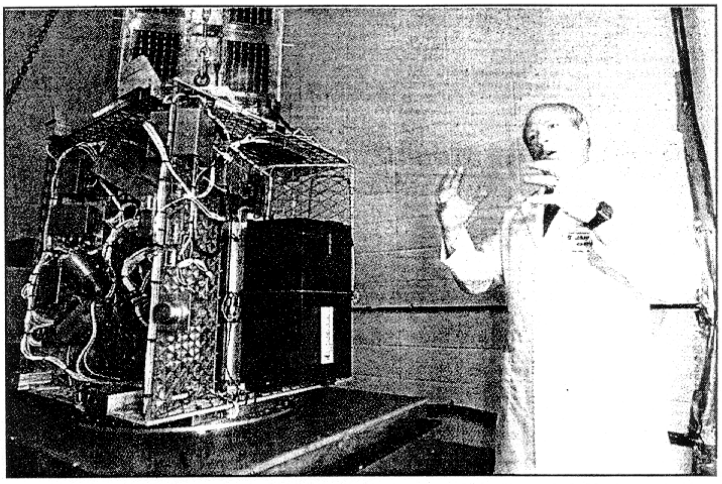
By RYAN R. OLIVER
Standard-Examiner staff

OGDEN – A Weber State University satellite will be the first-ever space delivery by a Minuteman II – the missile originally designed to be the backbone of America's nuclear weapons program.

The Oct. 15 launch will be conducted at Vandenburg Air Force Base in California as part of the United States Air Force's plan to make use of 450 intercontinental ballistic missiles left over from the Cold War.

"There's a lot of new concepts and technology involved in this project," said Jay Smith, director of WSU's Center for Aerospace Technology. "A lot of companies

▶ See SATELLITE/4A



BRIAN NICHOLSON/Standard-Examiner

PREPARING FOR LAUNCH: Weber State's Jay Smith explains a satellite students helped build.

Satellite

From 1A

are interested in this . . . and are waiting to see the results of the launch."

The Minuteman II was built to blast nuclear warheads into space and halfway around the planet from missile silos located throughout the United States.

But the Strategic Arms Reduction Talks treaty between the United States and the former Soviet Union recently phased 450 missiles out of service. The Air Force is hopeful the surplus missiles can be modified and used as a cheaper way to deliver satellites into orbit.

Smith said in addition to the innovative launch method, the 430-pound satellite itself incorporates new technologies designed by WSU students. Most important, he said, is an on-board guidance system that'll keep the satellite pointed in the same direction.

"Most student-built satellites can't do that," he said. "They tumble around in their orbit."

Having a satellite that can keep its instruments pointed to where they need to be and a solar panel continually facing the sun makes it much more useful for research and commercial applications, he said.

"This is the first satellite under $5 million that has these capabilities."

The satellite called JAWSAT, for Joint Air Force Academy and Weber State Satellite, will actually house four smaller satellites from other colleges and the Air Force. The smaller satellites will detach from the main satellite within three minutes of going into polar orbit.

Students at Stanford University built one of the smaller satellites that will itself launch three tiny satellites, each the size of a hockey puck. Their mission will be to take various measurements and communicate them back through a computer network to their main satellite.

An Air Force satellite on board will inflate itself into a silver balloon approximately 12 feet in diameter that will be visible from the Earth. The balloon is being used to help the Air Force calibrate its ground instruments at Kirtland Air Force Base in New Mexico being developed as part of America's ballistic missile defense system.

Arizona State University and the United States Air Force Academy also have satellite's hooked up to JAWSAT's gridded aluminum frame. ASU's experience is designed as a technology demonstrator for low-cost spacecraft using light, inexpensive materials. The Academy's project will test the effects of static electricity due to low-orbit flight on spacecraft.

Smith said once the satellites detach from Weber State's main satellite, the student-built guidance system will be tested. It has to keep a NASA experiment designed to collect atmospheric samples pointed in front of the spacecraft.

Smith said part of the projects goal is to test the feasibility of using smaller, less expensive satellites to carry out specialized missions.

Weber State, which is responsible for integrating the whole package, will be transporting the satellite from its Engineering Technology building to California over the weekend.

Rick Smith, one of more than 50 WSU students who has worked on the project, said the satellite has given him hands-on training in everything from mechanical engineering to computer-aided drafting.

"Working here is a unique experience. I don't think I could get it anywhere else," he said.

Smith plans to be in attendance for the launch, saying that after all his work, he deserves to be there.

"I have been so pumped up about this," he said. "Ever since we got our satellite frame populated, I could see this was going to happen."

You can reach reporter Ryan Oliver at 625-4229 or e-mail him at roliver@standard.net.

The Salt Lake Tribune Tuesday, September 21, 1999

WSU Gives New Life To ICBM

Old Minuteman missile to carry school's satellites

BY VINCE HORIUCHI

THE SALT LAKE TRIBUNE

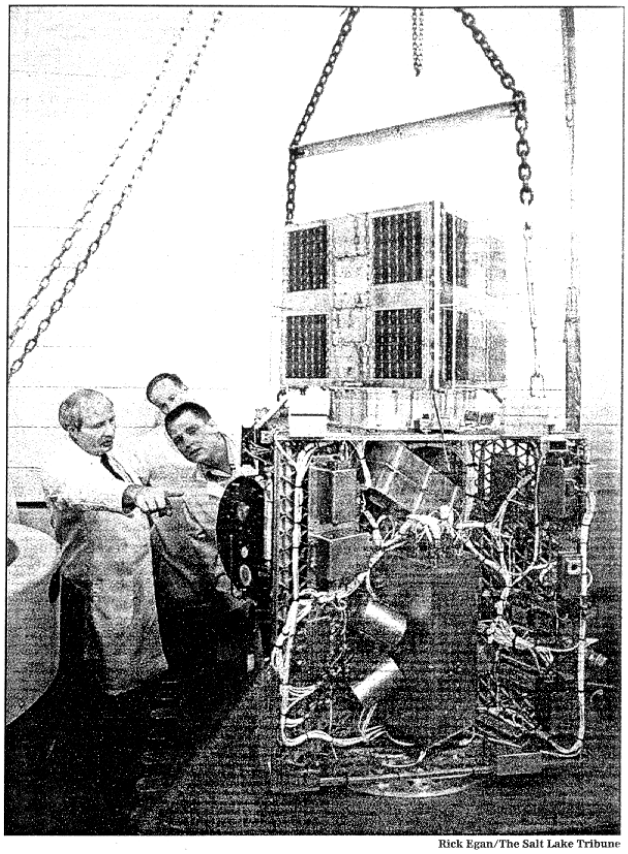
The Cold War may be over, but that will not stop Weber State University officials from launching a Minuteman intercontinental ballistic missile (ICBM).

The rocket is not aimed at Russia and will not carry multiple warheads. Instead, it will carry 11 satellites and a $1 million system of sensors designed by WSU professors and students to control one of the satellites.

This group of satellites, called JAWSAT (Joint Air Force Academy/Weber State University Satellite), will be the first orbital payload to be launched on a 60-foot, disarmed Minuteman II ICBM. Because of the SALT treaty, 354 Minuteman missiles were taken out of the nation's nuclear arsenal and reserved for other uses. As part of the Air Force's Orbital Suborbital Program (OSP), the government is using some of them as satellite-launch vehicles.

"We'll use them for whatever the customer base demands," said U.S. Air Force Maj. Steve Buckley, who is heading this launch project from Kirtland Air Force Base in Albuquerque. "Only a few will be used for orbital satellite missions. But we are clearly not limited to just satellite launches."

Weber State was contracted by the Air Force to package the satellites for launch on the Minuteman and provide a way to maneuver one of the satellites in space. The completed package of satellites must be delivered by Sept. 27 to California, where it will be attached to the rocket.



Rick Egan/The Salt Lake Tribune

Jay Smith of Weber State points out some of the features on the Weber State satellite to Scott Hasket of the Air Force Test Program and Steve Weis of Aerospace Corp., rear.

"They were looking for a payload to demonstrate the vehicle [missile], and that is what this first flight will be," said WSU electronics engineering technology professor Jay Smith, who heads the university project.

They are nicknaming the new rocket Minotaur, and the modified missile will have four stages instead of two to launch all of the satellites. It is scheduled to go up Oct. 15 from

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Launch Will Use WSU Technology

■ Continued from A-1

Vandenberg Air Force Base in Southern California.

In this payload, satellites from Arizona State University and Stanford will be deployed. Also on board will be an optical calibration sphere, a metalized balloon that will be used to calibrate a telescope for a New Mexico research company. The Air Force Academy also is deploying a satellite that will conduct experiments on electrical charging in space. Like people who build up static electricity by walking on a carpet, satellites flying through space also can accumulate a charge that can damage sensitive equipment.

Finally, the main payload will be a satellite from the NASA Marshall Spaceflight Test Center that will also conduct experiments on electrical charging, as well as measure ozone and hydrogen and oxygen particles in space.

That is where Weber State's project comes in. For 18 years, professors and about 50 students have been working on a system of computers and components that can help maneuver a small satellite in space. Before, small satellites were not capable of pointing in a particular direction and would just tumble in orbit.

This system, dubbed the Attitude Controlled Platform, will be attached to the NASA satellite. It contains sensors to tell which way the instrument is pointed. It also has reaction wheels that act like gyroscopes so it can be rotated.

"The students were involved in every phase," said Smith. "They are part of the engineering design team. They fabricated most of the parts that go into the satellite."

Eric Anderson, a senior in electrical engineering technology at WSU, worked on a camera system on the satellite so video could be taken in space to make sure each experiment was deployed correctly.

"This was the first time I was ever put in charge of a project," said Anderson, 25. "It wasn't hard, but it was challenging. I learned about design and making sure everything was taken care of."

This is not the first time the university has sent a payload into space. In fact, WSU was the first undergraduate college to send a satellite into space, according to school officials. In 1985, their first satellite measured high-altitude radar patterns for the Federal Aviation Administration. This current project and a communications satellite they have ready to launch from Florida marks four times the university has sent experiments into space, Smith said.

"This is by far the most complex project we have ever attempted," he said. "The previous satellites were all secondary payloads, so they were kind of hitchhikers on those launches. On this one, we are the payload. It's a major role in this Air Force project."

Part 6
Centers of Excellence

9-2-601. Purpose.

9-2-602. Short title - Definitions.

9-2-603. Administration - Grants.

9-2-601. Purpose.
(1) The Legislature recognizes that the growth of new industry and expansion of existing industry requires a strong technology base, new ideas, concepts, innovations, and prototypes. These generally come from strong research colleges and universities. Technical research in Utah's colleges and universities should be enhanced and expanded, particularly in those areas targeted by the state for economic development. Most states are enhancing their research base by direct funding, usually on a matching basis. The purpose of this part is to catalyze and enhance the growth of these technologies by encouraging interdisciplinary research activities in targeted areas. The Legislature recognizes that one source of funding is in matching state funds with federal funds and industrial support to provide the needed new technologies.
(2) The Legislature recommends that the governor consider the allocation of economic development funds for Centers of Excellence to be matched by industry and federal grants on at least a two-for-one basis.
(3) The Legislature recommends that such funds be allocated on a competitive basis to the various colleges and universities in the state. The funds made available should be used to support interdisciplinary research in specialized Centers of Excellence in technologies that are considered to have potential for economic development in this state.
History: C. 1953, 63-62-1, enacted by L. 1985, ch. 103, § 1; 1986, ch. 109, § 1; renumbered by L. 1992, ch. 241, § 60.

9-2-602. Short title - Definitions.
(1) This part is known as the "Centers of Excellence Act."
(2) As used in this part, "Centers of Excellence" means university-based, industry-supported, cooperative research and development programs.
History: C. 1953, 63-62-2, enacted by L. 1985, ch. 103, § 2; 1986, ch. 109, § 2; renumbered by L. 1992, ch. 241, § 61.

9-2-603. Administration - Grants.
(1) This part shall be administered by the Division of Business and Economic Development.
(2) The department may award grants to the various colleges and universities in the state for the purposes of this part.
(3) Recommendations for funding shall be made by the division with the advice of the State Advisory Council for Science and Technology, with the approval of the board. Each proposal shall receive the best available outside review.
(4) In considering each proposal, the division shall weigh technical merit, the level of matching funds from private and federal sources, and the potential for job creation and economic development. Proposals or consortia that combine and coordinate related research at two or more colleges and universities shall be encouraged.
(5) The State Advisory Council on Science and Technology shall review the activities and progress of individual centers on a regular basis and assist the division in preparing an annual report on the accomplishments and direction of the Centers of Excellence Program.
History: C. 1953, 63-62-3, enacted by L. 1986, ch. 109, § 3; renumbered by L. 1992, ch. 241, § 62.
Repeals and Reenactments. - Laws 1986, ch. 109, § 3 repealed former § 63-62-3, as enacted by L. 1953, ch. 103, § 3, relating to creation of a committee for technology excellence in engineering research, and enacted the above section.

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